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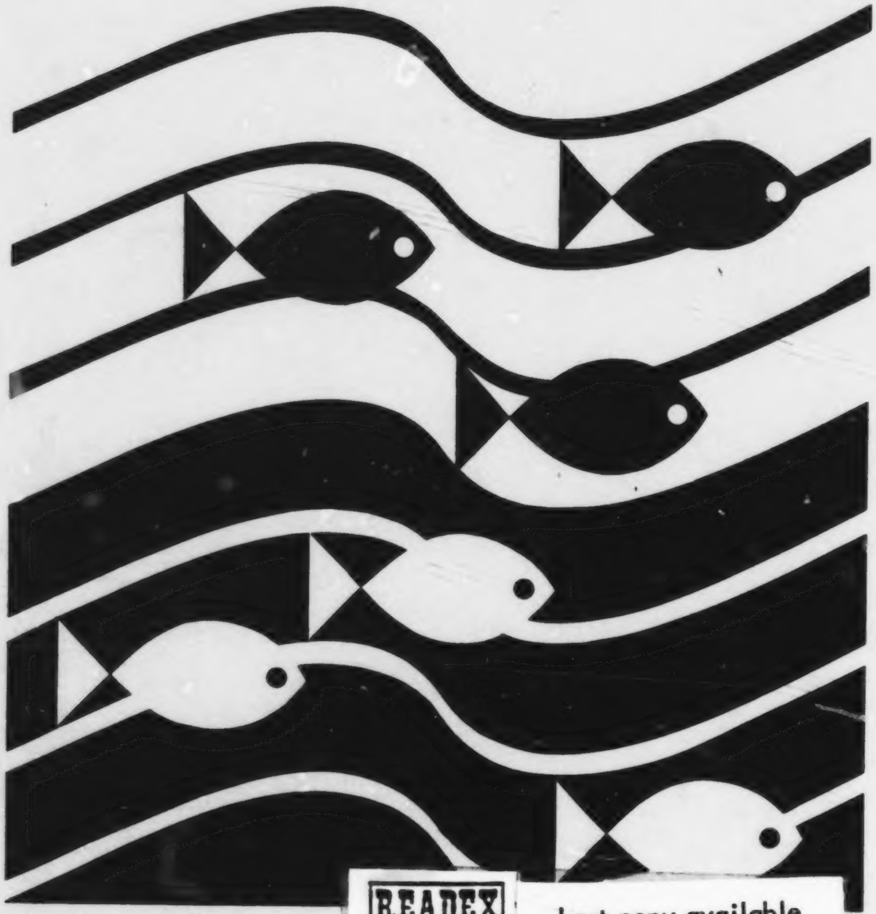

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Fisheries Review

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Fisheries Review is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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AQUATIC PLANTS AND THEIR CONTROL

86-000001 Harberg, M. C. and T. Modde. FEEDING BEHAVIOR, FOOD CONSUMPTION, GROWTH, AND SURVIVAL OF HYBRID GRASS CARP IN TWO SOUTH DAKOTA PONDS. *N. Am. J. Fish. Manage.* 5(3B):457-464. 1985. FR 31(1)
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[Physiol. Inst., Leningrad Univ., USSR]

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86-000013 Hansen, T. and K. R. Torrissen. ARTIFICIAL HATCHING SUBSTRATE AND DIFFERENT TIMES OF TRANSFER TO FIRST FEEDING: EFFECT ON GROWTH AND PROTEASE ACTIVITIES OF THE ATLANTIC SALMON *(SALMO SALAR)*. *Aquaculture* 48(2):177-188. 1985. FR 31(1)
[Dir. Fish., Inst. Mar. Res., Matre Aquacult. Stn., N-5198 Matredal, Norway] Groups of Atlantic salmon *(Salmo salar)* eggs were hatched in a Californian incubation system with and without an astro-turf artificial substrate. Food was first presented at four different points in development. Dry weight development and protease activities were studied. Irrespective of time of transfer, the astro-turf-reared fry were heavier than flat-screen-reared fry at the termination of the experiment. With respect to growth, the first and the fourth transfers were clearly suboptimal for the fry from both systems.

86-000014 Jennings, T. R. SURVIVAL, GROWTH AND FOOD HABITS OF YOUNG-OF-THE-YEAR ARCTIC GRAYLING STOCKED IN BARREN, SUB-ARCTIC LAKES. *M.S. thesis, Univ. Alaska* 69p. 1983. FR 31(1)
Since 1975 the Alaska Department of Fish and Game has used small, barren lakes near Delta Junction for the rearing of Arctic grayling. Sac-fry are stocked in June, reared for one summer, then recaptured and transplanted in September into the Delta Clearwater River. Survival was examined at various stocking densities (number/hectare) of sac-fry. No correlation existed between stocking density and survival over the range of densities tested (833 to [illegible],635 sac-fry/hectare). Qualitative evidence suggested that the high rate of mortality within a month after stocking was associated with specific food requirements at time of first feeding, sac-fry mobility and fitness, and predation by invertebrates. Growth rates were almost 2.0 mm/day in June, decreased to 0.5 mm/day by September and averaged over 1.0 mm/day for the entire summer. Larvae ate mainly chironomid pupae; diversity of food items increased with fish size and age.

86-000015 Luczynski, M. and R. Kolman. SURVIVAL AND GROWTH RATES OF VENDACE (*COREGONUS ALBULA* L.) LARVAE AFTER EXPERIMENTALLY DELAYED HATCHING. *Aquaculture* 50(1-2):13-21. 1985. FR 31(1)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Bl. 37, Poland] The time of hatching of vendace *(Coregonus albula)* embryos was artificially delayed so that it coincided with suitable thermal and food conditions in stocked lakes. By cooling the hatchery water to 1 to 2°C, successive batches of *C. albula* eleutheroembryos were obtained on 13, 21 and 25 April and 4 and 9 May. Then the batches of larvae were reared in tanks for 28 days at a constant temperature of 10.0±0.1°C. Survival of the corresponding batches of fish during the whole rearing period was 67, 70, 58, 63 and 72% respectively. Mean instantaneous rate of net biomass gain of the successive batches of fish was 7.35, 8.05, 7.04, 7.08 and 8.29% day^{-1}. The results of the experiment show that delaying hatching time did not reduce either survival or growth rate of *C. albula* larvae.

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WARMWATER CULTURE

86-000020 Ceskleba, D. G.; S. AveLallemant and T. F. Thuemler. ARTIFICIAL SPAWNING AND REARING OF LAKE STURGEON, *ACIPENSER FULVESCENS*, IN WILD ROSE STATE FISH HATCHERY, WISCONSIN, 1982-1983. *Environ. Biol. Fishes* 14(1):79-85. 1985. FR 31(1)
[Wis. Dep. Nat. Resour., Wild Rose State Fish Hatchery, Wild Rose 54984]
Attempts to culture lake sturgeon, *Acipenser fulvescens*, in the past have generally met with limited success. The Wisconsin Department of Natural Resources has been experimenting with artificial propagation of this species since 1979. The intent has been to develop egg collection and handling techniques, hatching regimes, larva and juvenile diet formulations, and to evaluate juvenile survival after stocking. Eggs were collected by caesarian section and fertilized with milt from ripe males taken during annual sturgeon spawning runs on the Fox and Wolf rivers in central Wisconsin. After insemination, the eggs were treated in a saturated solution of Bentonite clay and transported to the hatchery. Eggs were incubated at temperatures ranging 13-16°C and embryos began hatching within 4 to 8 days. Hatching success ranged from 42% to 96%. Yolksac absorption was complete within 10 days of hatching. Larvae then became positively phototactic and swam actively as if searching for food. Successful larval diets consisted of live brine shrimp nauplii followed by larger zooplankton, primarily *Daphnia* sp. Juveniles grew best on diets of live *Tubifex* sp. and chopped earthworms. Liver, fish mash (ground up trout) and pelleted dry food were poorly accepted. Hatchery reared sturgeon grew more slowly than did wild fish.

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[LSU Rice Res. Stn., P.O. Box 1429, Crowley, LA 70527]

86-000027 Campbell, D. LARGE SCALE CAGE FARMING OF *SAROTHERODON NILOTICUS*. *Aquaculture* 48(1):57-69. 1985. FR 31(1)
[2470 South Holly Place, Denver, CO 80222] Results from commercial cage farming of *S. niloticus* in the Ivory Coast over 1 year are given, together with efficient techniques for rearing large numbers of fry and fingerlings. Fry production from ponds was 4083 kg of fish averaging 1.7g. A total of 30.7 t of fish weighing 14 g mean weight were produced in 110 3-m^3 fingerling cages. Using 8500 m^3 of rearing cages, over 200 t were harvested. Mortality in the fingerling cages was 12.93% and 11.8% in rearing cages. Using a pelleted feed with 28% protein, food conversions were 1.75 with fish to 14 g mean weight, and 2.23 to harvest. For increasing mean population weight, minimum and maximum feed rations and corresponding growth for the fish are given.

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[Non-Native Fish Res. Lab., Fla. Game Fresh Water Fish Comm., 801 NW 40th St., Boca Raton 33431]

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MARICULTURE

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86-000051 Barnabe, G. and R. Barnabe-Quet. [ADVANCEMENT AND IMPROVEMENT OF INDUCED SPAWNING IN THE SEA-BASS *DICENTRARCHUS LABRAX* (L.) USING AN LHRH ANALOGUE INJECTION.] *Aquaculture* 49(2):125-132. 1985. In French with English summ. FR 31(1)
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[Dep. Fish., P.O. Box 699, Haifa 31000, Israel]

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86-000478 DeMartini, E. E. SOCIAL BEHAVIOR AND COLORATION CHANGES IN PAINTED GREENLING, *OXYLEBIUS PICTUS* (PISCES: HEXAGRAMMIDAE). *Copeia* 1985(4):966-975. 1985. FR 31(1)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

86-000479 Fay, R. R. SOUND INTENSITY PROCESSING BY THE GOLDFISH. *J. Acoust. Soc. Am.* 78(4):1296-1309. 1985. FR 31(1)
[Dep. Psychol., Parmly Hearing Inst., Loyola Univ. Chicago, 6525 N. Sheridan Rd., Chicago, IL 60626]

86-000480 Foster, N. R. ROLE OF CONSPECIFIC ODORS IN BEHAVIORAL ECOLOGY OF LAKE TROUT, *SALVELINUS NAMAYCUSH*. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:40. 1985. Abstract only. FR 31(1)
[U.S.FWS, Great Lakes Fish. Lab., 1451 Green Rd., Ann Arbor, MI 48105]

86-000481 Giles, N. and F. A. Huntingford. PREDATION RISK AND INTER-POPULATION VARIATION IN ANTI-PREDATOR BEHAVIOUR IN THE THREE-SPINED STICKLEBACK, *GASTEROSTEUS ACULEATUS* L. *Anim. Behav.* 32(1):264-275. 1984. FR 31(1)
[Sch. Life Sci., Univ. Buckingham, Buckingham MK18 1EG, England]

86-000482 Giles, N. DEVELOPMENT OF THE OVERHEAD FRIGHT RESPONSE IN WILD AND PREDATOR-NAIVE THREE-SPINED STICKLEBACKS, *GASTEROSTEUS ACULEATUS* L. *Anim. Behav.* 32(1):276-279. 1984. FR 31(1)
[Sch. Life Sci., Univ. Buckingham, Buckingham MK18 1EG, England]

86-000483 Golubev, A. V. ROLE OF CHEMICAL STIMULI IN GROUP AND SPAWNING BEHAVIOR OF ZEBRAFISH, *BRACHIDANIO RERIO*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 25(1):66-73. 1985. FR 31(1)
[Biol. Fac., Moscow State Univ., Moscow, USSR]

86-000484 Gross, M. R. and R. C. Sargent. THE EVOLUTION OF MALE AND FEMALE PARENTAL CARE IN FISHES. *Am. Zool.* 25(3):807-822. 1985. FR 31(1)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

86-000485 Grossman, G. D.; M. J. Harris and J. E. Hightower. THE RELATIONSHIP BETWEEN TILEFISH, *LOPHOLATILUS CHAMAELEONTICEPS*, ABUNDANCE AND SEDIMENT COMPOSITION OFF GEORGIA. *NOAA Fish. Bull.* 83(3):443-447.

86-000485 CONTINUED 1985. FR 31(1)
[Sch. For. Resour., Univ. Ga., Athens 30602]

86-000486 Hawryshyn, C. W.; B. R. Chou and R. D. Beauchamp. ULTRAVIOLET TRANSMISSION BY THE OCULAR MEDIA OF GOLDFISH: IMPLICATIONS FOR ULTRAVIOLET PHOTOSENSITIVITY IN FISHES. *Can. J. Zool.* 63(6):1244-1251. 1985. In English with French summ. FR 31(1)
[Sect. Ecol. Syst., Cornell Univ., Corson Hall, Ithaca, NY 14853-2701]

86-000487 Hearn, W. E. COMPETITION BETWEEN JUVENILE ATLANTIC SALMON (*SALMO SALAR*) AND RAINBOW TROUT (*S. GAIRDNERI*) IN THE WHITE RIVER OF VERMONT. *Ph.D. dissertation, Univ. Mass.* 97p. 1985. From Diss. Abstr. Int. B Sci. Eng. 46(6):1763. 1985. FR 31(1)

The methods and results of interspecific competition studies concerned with stream-dwelling populations of salmon and trout are reviewed, and the role of interspecific competition as a limiting factor in freshwater populations of these species are discussed. Coexistence of sympatric species is facilitated by species differences in habitat use which may result from species differences in aggressiveness, innate habitat preference, timing of emergence, growth rates, morphology, or a combination of these factors. Competition between stocked underyearling and yearling Atlantic salmon, *Salmo salar* and wild rainbow trout, *S. gairdneri*, in tributaries of Vermont's White River was examined in experiments conducted in stream aquariums, by field microhabitat surveys, and in a field experiment. The distributions of fish of these species of both ages differed in stream aquariums providing water of variable depth and velocity. No niche shift occurred in underyearlings of either species; however, yearling salmon occurred more often in aquarium riffle areas during trials with yearling rainbow trout than during trials using only salmon; trout distributions in the aquariums were unaffected by salmon. Data from six field surveys indicated that similarly aged salmon and trout occupied different depths. The positions occupied by similarly aged salmon and trout did not differ with respect to current velocity or substrate type. In late fall, segregation by habitat occurred: Atlantic salmon were primarily in riffles, and rainbow trout were primarily in pools. In a field experiment conducted to determine if the stocking of Atlantic salmon fry causes the displacement of resident rainbow trout fry, salmon fry were stocked at a density of 85 x 100 m^{-2} in June 1982 and fish movements from the stocked zone and an unstocked control zone were monitored daily with four fence-trap weirs. The salmon fry had no apparent effect on the rate of movement of resident rainbow trout fry. We found no evidence of competition between cohorts of underyearlings; however, the niche shift by salmon in the aquariums suggested interspecific competition for space occurred among yearlings.

86-000488 Hoffman, S. G. EFFECTS OF SIZE AND SEX ON THE SOCIAL ORGANIZATION OF REEF-ASSOCIATED HOGFISHES, *BODIANUS* SPP. *Environ. Biol. Fishes* 14(2-3):185-197. 1985. FR 31(1)
[Univ. Houston, Mar. Sci. Prog., 4700 Ave. U, Galveston, TX 77550]

86-000489 Hunter, J. and R. Nicholl. VISUAL THRESHOLD FOR SCHOOLING IN NORTHERN ANCHOVY *ENGRAULIS MORDAX*. *NOAA Fish. Bull.* 83(3):235-242. 1985. FR 31(1)
[NMFS, P.O. Box 271, La Jolla, CA 92038]

86-000490 Johansen, P. H. FEMALE PHEROMONE AND THE BEHAVIOUR OF MALE GUPPIES (*POECILIA RETICULATA*) IN A TEMPERATURE GRADIENT. *Can. J. Zool.* 63(5):1211-1213. 1985. In English with French summ. FR 31(1)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada]

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86-000491 Kirschvink, J. L.; M. M. Walker; S. Chang; A. E. Dizon and K. A. Peterson. CHAINS OF SINGLE-DOMAIN MAGNETITE PARTICLES IN CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*. *J. Comp. Physiol. Sens. Neural Behav. Physiol.* 157(3):375-381. 1985. FR 31(1)
[Div. Geol. Plan. Sci., Calif. Inst. Technol., Pasadena, CA 91125]

86-000492 Klimley, A. P. and D. R. Nelson. FUNCTIONAL ANALYSIS OF SCHOOLING IN THE SCALLOPED HAMMERHEAD (*SPHYRNA LEWINI*). *Natl. Geogr. Soc. Res. Rep.* 21:227-229. 1985. FR 31(1)
[Scripps Inst. Oceanogr., La Jolla, CA]

86-000493 Kobayashi, H. and Y. Goh. COMPARISON OF THE OLFACTORY RESPONSES TO AMINO ACIDS OBTAINED FROM RECEPTOR AND BULBAR LEVELS IN A MARINE TELEOST. *Exp. Biol.* 44(3):199-210. 1985. FR 31(1)
[Fac. Agric., Kinki Univ., Kowakae, Hiyashi-Osaka City, Osaka 577, Japan]

86-000494 Kobayashi, H. and Y. Ishida. [OLFACTORY RESPONSES IN MARINE FISH TO *CHATTONELLA* SP. BLOOMS.] *Bull. Jpn. Soc. Sci. Fish.* 51(9):1569. 1985. In Japanese with English summ. FR 31(1)
[Fac. Agric., Kinki Univ., Higashiosaka, Osaka 577, Japan]

86-000495 Koike, T. [A STUDY ON A FISH SCHOOL'S REACTION IN RESPONSE TO INTERMITTENT LIGHT.] *Bull. Jpn. Soc. Sci. Fish.* 51(7):1097-1102. 1985. In Japanese with English summ. FR 31(1)
[Fac. Fish., Mie Univ., Tsu, Mie 514, Japan]

86-000496 Korwin-Kossakowski, M. and B. Jezierska. THE INFLUENCE OF THERMAL CONDITIONS ON POSTEMBRYONIC DEVELOPMENT OF SOME SPECIES OF *COREGONIDAE* AND *CYPRINIDAE*. *Zool. Pol.* 31(1-4):43-56. 1984. FR 31(1)
[Inst. Appl. Biol. Agric., B. Prusa 12, 08-110 Siedlce, Poland]

86-000497 Lee, K. M. RESOURCE PARTITIONING AND BEHAVIORAL INTERACTIONS AMOUNG YOUNG-OF-THE-YEAR SALMONIDS, CHENA RIVER, ALASKA. *M.S. thesis, Univ. Alaska* 75p. 1985. FR 31(1)

The partitioning of habitat and food and the behavioral interactions of young-of-the-year Arctic grayling (*Thymallus arcticus*), chinook salmon (*Oncorhynchus tshawytscha*), and round whitefish (*Prosopium cylindraceum*) were studied in the laboratory and in their natural habitat. Individuals of all three species defended territories. Arctic grayling were the most aggressive of the three and appear to displace round whitefish from their preferred habitat. In sympatry, there is a segregation of habitat use between Arctic grayling and chinook salmon. Stomach content analysis showed an overlap in diet among the three species. Larvae of the three species emerged at different times and sizes, resulting in a size divergence among coexisting species during their first summer. The three species were found to inhabit faster moving and deeper water as they grew, resulting in a spatial separation of the species and a reduced probability of interactions and competition among them.

86-000498 Mac, M. J. EFFECTS OF RATION SIZE ON PREFERRED TEMPERATURE OF LAKE CHARR *SALVELINUS NAMAYCUSH*. *Environ. Biol. Fishes* 14(2-3):227-231. 1985. FR 31(1)
[Great Lakes Fish. Lab., U.S. FWS, 1451 Green Rd., Ann Arbor, MI 48105]

86-000499 Mechum, R. D. HABITAT UTILIZATION BY FISHES IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA. *M.S. thesis, Univ. Alaska* 128p. 1984. FR 31(1)

BEHAVIOR (CONTINUED)

86-000499 CONTINUED

This study evaluated summer habitat utilization of fishes and the effects of floodplain developments on fish and aquatic habitat in the glacially-fed Tanana River near Fairbanks, Alaska. Aquatic habitats were quantitatively described on the basis of water velocity, depth, and clarity, and substrate, cover and vegetation. Lake chub and longnose sucker were abundant in all habitats. Whitefishes, juvenile salmon, and northern pike were captured most frequently in areas with high water clarity. Burbot preferred deeper, turbid waters. Young-of-the-year of lake chub and longnose sucker preferred shallow, silty backwaters; juvenile lake chub demonstrated no habitat preferences; and adult lake chub, juvenile longnose sucker, and juvenile/adult slimy sculpin preferred gravel riffles. Bank stabilization activities have significantly modified aquatic habitat and fish communities of Tanana River backwaters. In general, free-flowing sidechannels have become blocked-off sloughs resulting in reduced turbidities and lower flows.

86-000500 Montgomery, J. C. and J. A. Macdonald. OCULOMOTOR FUNCTION AT LOW TEMPERATURE: ANTARCTIC VERSUS TEMPERATE FISH. *J. Exp. Biol.* 117:181-191. 1985. FR 31(1)
[Dep. Zool., Univ. Auckland, Auckland, New Zealand]

86-000501 Romero, A. ONTOGENETIC CHANGE IN PHOTOTACTIC RESPONSES OF SURFACE AND CAVE POPULATIONS OF *ASTYANAX FASCIATUS* (PISCES: CHARACIDAE). *Copeia* 1985(4):1004-1011. 1985. FR 31(1)
[Dep. Biol., Univ. Miami, P.O. Box 249118, Coral Gables, FL 33124]

86-000502 Savitz, J. and M. Thomas. MOVEMENTS AND HABITAT SELECTION OF INTRODUCED ADULT LARGEMOUTH BASS (*MICROPTERUS SALMOIDES*) IN AN ILLINOIS LAKE. *Trans., Ill. State Acad. Sci.* 78(3-4):191-197. 1985. FR 31(1)
[Dep. Biol., Loyola Univ. Chicago, 6525 N. Sheridan Rd., Chicago, IL 60626]

The movements, home areas, and habitat selection of introduced adult largemouth bass *(Micropterus salmoides)* released in an Illinois lake were studied by radiotelemetry. The fish moved from their release sites along the edge of a macrophyte patch, and then remained in one location for a short time period (2-13 days). Thereafter, they swam around the lake or moved to another location where they remained for a few days. Average daily movements of individual fish, excluding those within home areas, ranged from 129-324 m. Maximum distances for each fish varied from 290 m to 680 m. The sizes of home areas varied from 0.01 to 3.15 hectares. Often, two or more radio-tracked fish occurred in the same home area or were swimming around the lake together. All of the introduced largemouth bass were usually located (51% to 59% of a tracking day) in an ecotone, i.e., edge of macrophyte patch. Heavy macrophyte patches were also heavily utilized. Habitat selection for ecotones was significantly greater ($p < 0.05$) than that for any other habitat. Habitat selection for heavy macrophytes was second to that of ecotones and significantly different ($p < 0.05$) from other habitats. Whether fish were located in an ecotone or macrophyte patch, they were usually found around or in a small patch of broad leafed *Potamogeton* sp.

86-000503 Schlagenhaft, T. W. and B. R. Murphy. HABITAT USE AND OVERLAP BETWEEN ADULT LARGEMOUTH BASS AND WALLEYE IN A WEST TEXAS RESERVOIR. *N. Am. J. Fish. Manage.* 5(3B):465-470. 1985. FR 31(1)
[Tex. Parks Wildl. Dep., Box 835, Canyon 79015]

86-000504 Smith, D. A. AN EXPERIMENTAL ANALYSIS OF THE OPTOMOTOR RESPONSE IN FISHES. *Ph.D. dissertation, Rutgers Univ.* 63p. 1985. From Diss. Abstr. Int. B Sci. Eng. 46(6):2117. 1985. FR 31(1)

86-000505 Soeda, H.; K. Yoza; T. Shimamura; E. Hasegawa and K. Yoshihara. [ON THE VERTICAL MOVING BEHAVIOUR OF CHUM SALMON EARLY MIGRATORY SEASON OFF THE COAST OF SHIRETOKO PENINSULA.] *Bull. Jpn. Soc. Sci. Fish.*

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86-000505 CONTINUED 51(9):1425-1429. 1985. In Japanese with English summ. FR 31(1)
[Coll. Agric. Vet. Med., Nihon Univ., Setagaya, Tokyo 154, Japan]

86-000506 Sorokin, M. A. and A. N. Lebedeva. [BEHAVIOUR AUDIOGRAMMS OF SOME FISHES WITHOUT SWIM BLADDER.] *Biol. Nauki (Mosc.)* 9(261):45-49. 1985. In Russian with English summ. FR 31(1)

86-000507 Steiner, W. W. and B. L. Olla. BEHAVIORAL RESPONSES OF PREJUVENILE RED HAKE, *UROPHYCIS CHUSS*, TO EXPERIMENTAL THERMOCLINES. *Environ. Biol. Fishes* 14(2-3):167-173. 1985. FR 31(1)
[Univ. Miami Sch. Med., Miami, FL 33101]

86-000508 Sweatman, H. P. A. THE INFLUENCE OF ADULTS OF SOME CORAL REEF FISHES ON LARVAL RECRUITMENT. *Ecol. Monogr.* 55(4):469-485. 1985. FR 31(1)
[Sch. Biol. Sci., Macquarie Univ., North Ryde, NSW 2113, Australia]

86-000509 Videler, J. J. FISH SWIMMING MOVEMENTS: A STUDY OF ONE ELEMENT OF BEHAVIOUR. *Neth. J. Zool.* 35(1-2):170-185. 1985. FR 31(1)
[Dep. Zool., Univ. Groningen, PB 14, 9750 AA Haren, Netherlands]

86-000510 Whoriskey, F. G. and G. J. FitzGerald. SEX, CANNIBALISM AND STICKLEBACKS. *Behav. Ecol. Sociobiol.* 18:15-18. 1985. FR 31(1)
[Dep. Zool., Univ. Coll. Wales, Aberystwyth, Dyfed SY23 3DA, Wales] Two closely related species of sticklebacks (Pisces: Gasterosteidae), breeding in the same site at the same time, showed different patterns of egg cannibalism. In *Gasterosteus aculeatus* the intensity of cannibalism was density-dependent and females were the most important cannibals. In *G. wheatlandi* cannibalism was not density-dependent and males ate more eggs than females. This study indicates that sex-specific patterns of cannibalism can differ widely between species despite their similar ecology, and it provides evidence inconsistent with a currently popular explanation for egg cannibalism.

86-000511 Wilson, R. R., Jr. DEPTH-RELATED CHANGES IN SAGITTA MORPHOLOGY IN SIX MACROURID FISHES OF THE PACIFIC AND ATLANTIC OCEANS. *Copeia* 1985(4):1011-1017. 1985. FR 31(1)
[Mar. Biol. Res. Div., A-002, Scripps Inst. Oceanogr., La Jolla, CA 92093]

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[Cent. Environ. Estuarine Stud., Gunter Hall, Frostburg, MD 21532]

86-000513 Zerbolio, D. J., Jr. CATEGORICAL COLOR CODING IN GOLDFISH. *Anim. Learning Behav.* 13(3):269-273. 1985. FR 31(1)
[Univ. Mo., St. Louis]

LIFE HISTORY-GENERAL WORKS

86-000514 Abraham, B. J. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (MID-ATLANTIC). MUMMICHOG AND STRIPED KILLIFISH. *U.S. Fish Wildl. Serv.*

LIFE HISTORY-GENERAL WORKS (CONTINUED)

86-000514 CONTINUED *Biol. Rep.* 82(11.40). vi + 23p. 1985. FR 31(1)
[Dep. Biol. Sci., P.O. Box 6565, Hampton Univ., Hampton, VA 23668]

86-000515 Appa Rao, T. ON SOME ASPECTS OF BIOLOGY OF *PRIACANTHUS MACRACANTHUS* (CUVIER). *Indian J. Fish.* 31(3):380-382. 1984. FR 31(1)
[CMFR Inst., Veraval, India]

86-000516 Armstrong, R. H. A REVIEW OF ARCTIC GRAYLING STUDIES IN ALASKA. *Alaska Coop. Fish. Res. Unit Contrib.* No. 6. 60p. 1982. FR 31(1)

86-000517 Binkowski, F. P. and S. I. Doroshov, (eds.). NORTH AMERICAN STURGEONS: BIOLOGY AND AQUACULTURE POTENTIAL. *Environ. Biol. Fishes* 14(1):2-96. 1985. FR 31(1)

86-000518 Cambray, J. A. and C. T. Stuart. ASPECTS OF THE BIOLOGY OF A RARE REDFIN MINNOW, *BARBUS BURCHELLI* (PISCES, CYPRINIDAE), FROM SOUTH AFRICA. *S. Afr. J. Zool.* 20(3):155-165. 1985. In English with Afrikaans summ. FR 31(1)
[Albany Mus., Somerset St., Grahamstown, 6140 South Africa]

86-000519 Carlson, D. M.; W. L. Pflieger; L. Trial and P. S. Haverland. DISTRIBUTION, BIOLOGY AND HYBRIDIZATION OF *SCAPHIRHYNCHUS ALBUS* AND *S. PLATORYNCHUS* IN THE MISSOURI AND MISSISSIPPI RIVERS. *Environ. Biol. Fishes* 14(1):51-59. 1985. FR 31(1)
[N.Y. Dep. Environ. Conserv., Stamford, NY 12167]

86-000520 Claridge, P. N.; M. W. Hardisty; I. C. Potter and C. V. Williams. ABUNDANCE, LIFE HISTORY AND LIGULOSIS IN THE GOBIES (TELEOSTEI) OF THE INNER SEVERN ESTUARY. *J. Mar. Biol. Assoc. U.K.* 65(4):951-968. 1985. FR 31(1)
[N.E.R.C. Inst. Mar. Environ. Res., Prospect Place, The Hoe, Plymouth PL1 3DH, England]

86-000521 Collette, B. B. and J. L. Russo. MORPHOLOGY, SYSTEMATICS, AND BIOLOGY OF THE SPANISH MACKERELS (*SCOMBEROMORUS*, SCOMBRIDAE). *NOAA Fish. Bull.* 82(4):545-692. 1984. FR 31(1)
[NMFS, Syst. Lab., Natl. Mus. Nat. Hist., Washington, DC 20560]

86-000522 Collins, M. R. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVEREBRATES (SOUTH FLORIDA). STRIPED MULLET. *U.S. Fish Wildl. Serv. Biol. Rep.* 82(11.34). vi + 11p. 1985.
[Dep. Zool., Univ. Fla., Gainesville 32611]

86-000523 Collins, M. R. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (SOUTH FLORIDA). WHITE MULLET. *U.S. Fish Wildl. Serv. Biol. Rep.* 82(11.39). v + 7p. 1985. FR 31(1)
[Dep. Zool., Univ. Fla., Gainesville 32611]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

86-000524 Crance, J. H. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: INLAND STOCKS OF STRIPED BASS. *U.S. Fish Wildl. Serv.* FWS/OBS-82/10. viii + 63p. 1984. FR 31(1)
[U.S. FWS, 2625 Redwing Rd., Ft. Collins, CO 80526]

86-000525 Dimond, W. F.; T. W. Storck and K. C. Kruse. A TURBIDITY-RELATED DELAY IN BLUEGILL (*LEPOMIS MACROCHIRUS*) REPRODUCTION AND SOME SIZE-DEPENDENT DIFFERENCES IN THE SPATIAL DISTRIBUTION OF BLUEGILL FRY. *Trans. Ill. State Acad. Sci.* 78(1-2):49-56. 1985. FR 31(1)
[Ill. Nat. Hist. Surv., R.F.D. 1, Box 157, Sullivan 61951] The initiation of bluegill reproduction and the abundance and spatiotemporal distribution of bluegill fry were investigated in a central Illinois pond. High turbidity delayed successful reproduction, resulting in a short growing season. Small bluegill fry (14.0-20.0 mm total length) were generally most abundant at the 1-m depth at offshore locations, and large bluegill fry (20.5-26.5 mm) were generally most abundant at shoreline locations, supporting a littoral-limnetic-littoral migration pattern documented in published accounts. However, small bluegill fry were abundant at two shoreline locations, indicating that some bluegill fry either did not migrate to open water or returned to the shoreline at a smaller size than has been previously documented. A small mean length of age 0 bluegill in September followed the reduced growing season.

86-000526 Dovel, W. L. and T. J. Berggren. ATLANTIC STURGEON OF THE HUDSON ESTUARY, NEW YORK. *N.Y. Fish Game J.* 30(2):140-172. 1983. FR 31(1)
[Malcolm Pirnie, Inc., 2 Corporate Park Drive, White Plains, NY 10602]

86-000527 Geistdoerfer, P. [TAXONOMY, ECOLOGY AND DISTRIBUTION OF A FISH ZOARCID FROM HYDROTHERMAL VENTS ON EAST PACIFIC RISE.] *C.R. Acad. Sci. Ser. III Sci. Vie* 301(7):365-368. 1985. In French with English summ. FR 31(1)
[Ichtyol., Mus. Natl. Hist. Nat., 43, rue Cuvier, 75231 Paris Cedex 05, France]

86-000528 Gnanamuttu, J. C. and K. G. Girijavallabhan. SOME PRELIMINARY OBSERVATIONS ON THE *RASTRELLIGER FAUGHNI* MATSUI OCCURRING IN THE MADRAS COASTAL WATERS. *Indian J. Fish.* 31(3):383-386. 1984. FR 31(1)
[CMFR Inst., Madras, India]

86-000529 Golani, D. and A. Ben-Tuvia. THE BIOLOGY OF THE INDO-PACIFIC SQUIRRELFISH, *SARGOCENTRON RUBRUM* (FORSSKAL), A SUEZ CANAL MIGRANT TO THE EASTERN MEDITERRANEAN. *J. Fish Biol.* 27(3):249-258. 1985. FR 31(1)
[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem, Israel] A biological study of the adult population of the Suez Canal migrant, the squirrelfish, *Sargocentron rubrum*, in the Mediterranean coast of Israel, was carried out between October 1979 and October 1980. *Sargocentron rubrum* in the Mediterranean has a short spawning season lasting from July to August. The largest ripe oocytes reach a diameter of 200um. The ratio of males to females was to be 1:2. Hyaline rings on otoliths were used for aging. Growth rate was obtained by back calculation and by using von Bertalanffy's equation. The results obtained from both methods were close, 94mm S.L. after 16 months, 125-127mm after 28 months, 143-144mm after 40 months and 155mm after 52 months. Age groups older than 4 years were not found in the present study. The descriptions of early stages of development were based on samples collected by dip and neuston nets along the Mediterranean coast of Israel.

LIFE HISTORY-GENERAL WORKS (CONTINUED)

86-000530 Gopinatha Menon, N. ON THE BIOLOGY OF THE FLAT MOUTHED CATFISH *TACHYSURUS PLATYSTOMUS* (DAY) FROM MANDAPAM. *Indian J. Fish.* 31(2):293-308. 1984. FR 31(1)
[Calicut Res. Cent., Cent. Mar. Fish. Res. Inst., Calicut, India]

86-000531 Gordon, M. S.; H. G. Chin and K. L. Martin. ASPECTS OF THE ECOPHYSIOLOGY OF TERRESTRIALITY IN *ALTICUS KIRKI*, THE ROCKSKIPPER BLENNY OF THE RED SEA. *Am. Zool.* 123A. 1985. Abstract only. FR 31(1)
[Univ. Calif., Los Angeles]

86-000532 Hale, S. S.; T. E. McMahon and P. C. Nelson. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: CHUM SALMON. *U.S. Fish Wildl. Serv. Biol. Rep.* 82(10.108): vi + 48p. 1985. FR 31(1)
[Alaska Dep. Fish Game, 333 Raspberry Rd., Anchorage, AK 99502-2392]

86-000533 Harris, D. and P. S. Lake. ASPECTS OF THE BIOLOGY OF BASTARD TRUMPETER, *LATRIDOPSIS FORSTERI* (CASTELNAU, 1872) IN TASMANIAN WATERS. *Tasmanian Fish. Res.* No. 27. 19-43. 1985. FR 31(1)
[Cent. Environ. Stud., Univ. Tasmania, Sandy Bay, Tasmania 7005, Australia]

86-000534 Harris, D. and P. S. Lake. ASPECTS OF THE BIOLOGY OF BASTARD TRUMPETER, *LATRIDOPSIS FORSTERI* (CASTELNAU, 1872) IN TASMANIAN WATERS. *Tasmanian Fish. Res.* No. 27. 19-43. 1985. FR 31(1)
[Cent. Environ. Stud., Univ. Tasmania, Sandy Bay, Tasmania 7005, Australia]

86-000535 Hatch, M. D.; W. H. Baltosser and C. G. Schmitt. LIFE HISTORY AND ECOLOGY OF THE BLUNTNOSE SHINER *(NOTROPIS SIMUS PECOSENSIS)* IN THE PECOS RIVER OF NEW MEXICO. *Southwest. Nat.* 30(4):555-562. 1985. FR 31(1)
[N. Mex. Dep. Game Fish., State Capitol, Santa Fe 87503]

86-000536 Hubert, W. A.; R. S. Helzner; L. A. Lee and P. C. Nelson. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: ARCTIC GRAYLING RIVERINE POPULATIONS. *U.S. Fish Wildl. Serv. Biol. Rep.* 82(10.110): vii + 34p. 1985. FR 31(1)
[Wyo. Coop. Fish. Wildl. Res. Unit, Univ. Wyo., Laramie 82071]

86-000537 Hutchings, J. A. and D. W. Morris. THE INFLUENCE OF PHYLOGENY, SIZE AND BEHAVIOUR ON PATTERNS OF COVARIATION IN SALMONID LIFE HISTORIES. *Oikos* 45(1):118-124. 1985. In English with Russian summ. FR 31(1)
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86-000541 Lester, R. J. G. and R. A. Watson. GROWTH, MORTALITY, PARASITISM, AND POTENTIAL YIELDS OF TWO *PRIACANTHUS* SPECIES IN THE SOUTH CHINA SEA. *J. Fish Biol*. 27(3):307-318. 1985. FR 31(1)

[Dep. Parasitol., Univ. Queensland, Brisbane, Qld. 4067, Australia] In the northern part of the South China Sea the 'big-eye', *Priacanthus tayenus*, spawned once a year in June, had von Bertlanffy growth parameters of k= 0.8 and L=30cm, and a mean total annual instantaneous mortality of Z=2.0, calculated from adjusted catch curves and a mean length equation. The natural mortality rate M=1.4, fishing mortality rate F=0.6, and the exploitation rate (E) was 0.27. The maximum potential yield, calculated using Marten's method, was 0.06kg/recruit when F=5.4. The fish were heavily parasitised by the protozoan *Pleistophora priacanthicola*. A second big-eye *P. macracanthus*, spawned twice a year in May-June and September, had growth paramaters of K=0.7 and L=32, and population parameters of Z=2.0 and F=0.7, and E=0.34. The maximum potential yield was o.13kg/recruit when F=5.8. A marked reduction in fishing mortality occurred for both species between 1965 and 1966, coinciding with the onset of the Chinese Cultural Revolution. Our estimates of maximum potential yield correspond to fishing mortalities eight times estimated levels, though such heavy exploitation could risk recruitment failure.

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86-000543 MacKenzie, C.; L. S. Weiss-Glanz and J. R. Moring. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (MID-ATLANTIC). AMERICAN SHAD. *U.S. Fish Wild. Serv. Biol. Rep*. 82(11.37). vi + 18p. 1985. FR 31(1)

[Me. Coop. Fish. Res. Unit, 313 Murray Hall, Univ. Me., Orono 04469]

86-000544 Martin-Bergmann, K. A. and J. H. Gee. THE CENTRAL MUDMINNOW, *UMBRA LIMI* (KIRTLAND), A HABITAT SPECIALIST AND RESOURCE GENERALIST. *Can. J. Zool*. 63(8):1753-1764. 1985. In English with French summ. FR 31(1)

[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada] The central mudminnow, *Umbra limi* (Kirtland), successfully inhabits a variable and unpredictable environment in southern Manitoba streams. *Umbra* accomplishes this by specializing in habitat and generalizing in resources utilized and life history strategies displayed. Mudminnows are restricted to still waters and show a preference for a variety of cover types. They are morphologically, physiologically, and behaviourally specialized for this habitat. *Umbra limi* inhabits areas subjected to hypoxia and all sizes are able to use both atmospheric and aquatic respiration. Mudminnows are euryphagic carnivores that eat aquatic and terrestrial invertebrates and fish. They feed from a variety of locations (benthic, midwater, and surface) and organisms attached to vegetation are included in the diet. Activity patterns (including feeding) vary daily and seasonally. Differences in rate of growth, age at first maturity, gonadal development, and survival occur between sexes. Individual and population variability is apparent. Spawning time varies and there is evidence for delayed spawning under unfavourable conditions.

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[Savannah River Ecol. Lab., Drawer E, Aiken, SC 29801]

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[Vizhinjam Res. Cent., CMFR Inst., Vizhinjam, India]

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[Coll. Oceanogr., Oreg. State Univ., Corvallis 97331] *Bathylychnops exilis* is an unusual north-eastern Pacific mesopelagic fish of which adults have previously been undescribed and the biology is poorly known. Its sensory and digestive systems are highly modified. Sensory modifications include the equivalent of four functional eyes, well developed nasa rosettes, and lateral line canals up to 4mm in diameter. Digestive adaptations include a peculiar mouth, a large tongue, crumenal organ, and a large caecal stomach. *Bathylychnops exilis* apparently lacks an anal light organ. Ontogenetic changes occur in the morphology of the head, eyes, body, and coloration. *Bathylychnops exilis* eats crustaceans and maybe medusae and microscopic organisms. Reproduction probably occurs in late summer. Adults occur most commonly at about 500m depth, possibly in groups, and may be diurnal vertical migrators.

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[Dep. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061] Life history aspects of *Etheostoma rufilineatum*, the redline darter, were investigated from May 1981 to May 1982 in the North Fork Holston River, Virginia. Analysis of scale samples indicated that males and females grew at approximately the same rate, but males reached a greater maximum length. Estimated annual survival rate for age II and older males was 0.28 and for females 0.03. Aquatic insect larvae were the major food items, and dipterans predominated numerically (68-87%) year-round. Feeding over a 24-hour period peaked from early to late afternoon (1600-2000 hr). The sex ratio favored males throughout the year (2.5:1) and was attributed to differential survival and distribution. Age I fish more than 42 mm long, of both sexes, were sexually mature. Ripe males were first collected in March, although spawning coloration was evident in December. Female ovaries began maturing in late February, and spawning occurred from mid-May to mid-August.

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[U.S. FWS, Western Energy Land Use Team, 2627 Redwing Rd., Fort Collins, CO 80526-2899]

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SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

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The roundnose minnow, *Dionda episcopa*, is primarily restricted to clear spring-fed waters that have slight temperature variations. Ova diameters, numbers of separated ova, and gonadosomatic index indicate that spawning occurred from January thru August with a peak occurring in April and May and a second peak in July and August. Spawning peaks occurred when the number of daylight hours were approximately the same (14 hours). There was a significant positive correlation between the number of separated mature ova and the standard length of the fish. *D. episcopa* showed no significant deviation from one-to-one sex ratio.

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[Cent. Lake Superior Stud., UW-Superior, Superior, WI 54880] Many methods of calculating daily prey consumption by fish rely on estimates of the number of meals consumed per day, average meal size, and the gut evacuation rate. Errors can occur when these estimates are made for young of the year fish with tubular digestive tracts and indistinct stomachs. For these fish, gut evacuation rates are dependent on ingestion rates. At high prey densities food may pass through the gut without being digested. Food may also be egested during capture of the fish and result in underestimates of daily prey consumption. A laboratory method of estimating daily consumption rates of young fish has been developed. Fish with empty digestive tracts are allowed to feed on Crustacean zooplankton for 24 hours. The feces produced by the fish during this time period are collected and dissected. Crustacean hardparts are readily visible, often intact and more easily identified than when in the stomach contents. Lab studies using young rainbow smelt demonstrate that prey consumption is linearly related to prey density. Laboratory estimates of daily consumption rates were greater than field estimates.

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[Coll. Environ. Sci. For., State Univ. N.Y., Syracuse 13126] Stomachs of 1,910 adult trout and salmon from Lake Ontario were examined during April through September 1983 and 1984. Samples were collected from fish registered at fishing tournaments held in New York State and represent lake trout (*Salvelinus namaycush*, 30.1% of total), brown trout (*Salmo trutta*, 27.0%), rainbow trout (*S. gairdneri*, 3.8%), coho salmon(*Oncorhynchus kisutch*, 23.8%) and chinook salmon (*O. tschawytscha*, 15.2%). Diet overlap was high among all salmonids and diet composition was nearly identical in 1983 and 1984. Alewives (*Alosa pseudoharengus*) were the dominant food item for all salmonids during all seasons and were mainly 110-149mm in standard length. Rainbow smelt (*Osmerus mordax*) were the second most common prey eaten but generally had less than 20% occurence

FOODS/FEEDING (CONTINUED)

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AGE AND GROWTH

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[Inst. Fom. Pesq., Casilla 1287, Santiago, Chile] The formation pattern of growth rings in otoliths of chilean pilchard (*Sardinops sagax*) and horse mackerel (*Trachurus murphyi*) of the northern zone of Chile during the occurrence of the 1982-83 El Niño are compared with the ones of a normal period, with the purpose to determine the possible effects induced by this atmospheric-oceanographic alteration. No changes are appreciated in the number of annually formed growth rings, otherwise an alteration on the time distribution pattern of hyaline and opaque rings formed in the edge is observed, lacking the usual maximums. In general the opaque ring which is formed on the otolith edge reflecting the fish active growth rate, remains with values and variations lower to the ones of a "normal period" indicating changes on the growth rate of fishes. An analysis is performed, furthermore, to the average radius of annual rings and to the relationships fish length-otolith radius, fish length-age and weigth-age for the 1981-83 period. The latter ratio is the most affected by El Niño. It is therefore that the chilean pilchard shows a larger amount of weigth loss in Coquimbo than in Iquique, occurring the contrary to the horse mackerel.

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86-000728 CONTINUED 25(1):49-59. 1985. FR 31(1)
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[B. Gjerde: Agric. Res. Couns. Norway, Inst. Aquacult. Res., 1432 AS-NLH, Norway] Rainbow trout of two ages (10 months and 1½ years) were grown for 12 weeks at salinities of 0, 10, 20, 24, 28 or 32 °/oo Average initial weights varied from 51 g to 153 g, depending on age. Mortality increased with increasing salinity, from 0 percent at 0 and 10 °/oo to 13 percent at 32 °/oo. Growth decreased as salinity increased, declining more rapidly per unit increase in salinity after 20 °/oo. Appetite was significantly better at 0 °/oo than at 10, 20, or 32 °/oo. It is concluded that salinities above 20 °/*oo** may have detrimental effects on biomass production, and so salinity should be one of the factors considered when choosing a site for rainbow trout cage culture in Norwegian fjords.

86-000732 Michener, W. K. and A. G. Eversole. AGE, GROWTH, AND SEX RATIO OF AMERICAN EELS IN CHARLESTON HARBOR, SOUTH CAROLINA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 37:422-431. 1983. FR 31(1)
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86-000733 Miller, S. J. and B. L. Tetzlaff. DAILY GROWTH INCREMENTS IN OTOLITHS OF LARVAL WALLEYE (*STIZOSTEDION VITREUM*). *Trans. Ill. State Acad. Sci.* 78(1-2):115-120. 1985. FR 31(1)
[Lake Okechobee Fish. Off., 3991 SE 27th Ct., Okechobee, FL 33472] Growth increments were formed daily in the otoliths of laboratory-reared walleye (*Stizostedion vitreum*) larvae for at least 19 days after swimup. The periodicity of increment formation did not differ between two groups of walleye growing at different rates. A metamorphic check in the otolith corresponding to the date of swimup (first feeding) was counted as the first daily increment. Distinct increments formed in the otolith prior to swimup but the number of increments did not correspond to the number of days from hatching. Subdaily increments were also visible in all otoliths examined, but were weakly defined. A linear relationship existed between otolith radius and fish length. Increments observed in the otoliths of field-collected walleye larvae were more distinct than those in laboratory-reared specimens, suggesting that age estimates of field-collected specimens may be more accurate.

86-000734 Neilson, J. D. and G. H. Geen. EFFECTS OF FEEDING REGIMES AND DIEL TEMPERATURE CYCLES ON OTOLITH INCREMENT FORMATION IN JUVENILE CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*. *NOAA Fish. Bull.* 83(1):91-101. 1985.

AGE AND GROWTH (CONTINUED)

86-000734 CONTINUED FR 31(1)
[Mar. Fish. Div., Biol. Stn., St. Andrews, NB E0G 2X0, Canada] The effects of constant diel cyclic water temperature regimes, feeding frequency, fish activity, and ration level on growth increment formation in juvenile chinook salmon, *Oncorhynchus tshawytscha*, are described. Of the variables examined, any event which recurred more than once every 24 hours increased the rate of increment production above 1 increment per 24 hours. The results were consistent with the hypothesis that environmental variables modify the rate of increment formation by altering the periodicity of fish activity. Both water temperature and ration level interacting with water temperature affected otolith increment width, a measure of fish growth, although ration level did not.

86-000735 Nelson, R. S. GROWTH OF GRAY TRIGGERFISH *BALISTES CAPRISCUS*, ON EXPLORATORY OIL DRILLING PLATFORMS AND NATURAL REEF AREAS IN THE NORTHWESTERN GULF OF MEXICO. *Bull. Mar. Sci.* 37(1):399. 1985. Abstract only. FR 31(1)
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[INVEMAR, Apt. 1016, Santa Marta (Mag.), Colombia]

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86-000740 Secor, D. H. DAILY INCREMENT FORMATION AND GROWTH OF OTOLITHS IN LARVAL STRIPED BASS *(MORONE SAXATILIS)*. *Bull. S.C. Acad. Sci.* 47:162. 1985. Abstract only. FR 31(1)
[Dep. Biol., Univ. S.C., Columbia] Hatchery produced seven day old striped bass were stocked into ponds at Dennis Wildlife Center, South Carolina, and sampled weekly for 45 days. The otoliths were removed from the fish, sectioned, and examined using light and scanning electron microscopy. The first growth increment within the otolith's microstructure was observed to coincide with yolk sac resorption and mouth formation at four days after hatch; subsequent growth increments occurred at a daily rate. Two ponds provided environments for drastically different survivorship and growth, suggesting that fish growth was affected by density. There was a significant difference between the allometric relationship of body and otolith length for fish from these two ponds. Therefore, fish growth may not be interpreted directly from the growth of the otolith.

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86-000741 Secor, D. H.; J. M. Dean and P. W. Haake. SOMATIC-OTOLITH GROWTH COMPARISONS IN LARVAL AND JUVENILE STRIPED BASS AND SPOT. *Am. Zool.* 25(4):53A. 1985. Abstract only. FR 31(1)
[Belle W. Baruch Inst. Mar. Biol. Coastal Res., Univ. S.C., Columbia 29208]

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[Fla. Game Fresh Water Fish Comm., 1239 S.W. 10th St., Ocala 32674] The use of otoliths for aging hybrid striped bass (*Morone chrysops* x *M. saxatilis*), proved successful in central Florida where reading scales is not a reliable method. Verification of annulus formation was accomplished by checking known-age fish, determining the time of annulus formation and comparing assigned ages of fish with stocking records to verify that the number of annuli was not greater than expected. Aging by reading otoliths revealed that hybrids live at least 3 years longer than indicated by reported growth rates and length frequency analysis.

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Growth of young-of-the-year Arctic grayling (*Thymallus arcticus*), chinook salmon (*Oncorhynchus tshawytscha*) and round whitefish (*Prosopium cylindraceum*), was examined in the Chena River during 1981 and 1982. Each species exhibited a gradient of growth within the main river; faster growing fish were found downstream. Highest growth rates occurred in Badger Slough, a clearwater tributary that parallels the lower river. Fish condition followed a similar pattern; faster growing fish were heavier at a given size. Between year differences in environmental conditions affected the first appearance, distribution and growth of these species. Growth pattern was reflected on the scales of Arctic grayling. Faster growing fish had a greater number of circuli that were more widely spaced. For fish from the lower river and Badger Slough, the number of circuli formed by the end of the growing year was not significantly different between years. This characteristic may be used to identify Chena River Arctic grayling stocks.

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86-000753 Bivens, R. D.; R. J. Strange and D. C. Peterson. CURRENT DISTRIBUTION OF THE NATIVE BROOK TROUT IN THE APPALACHIAN REGION OF TENNESSEE. *J. Tenn. Acad. Sci.* 60(4):101-105. 1985. FR 31(1)
[Univ. Tenn., Knoxville 37901] Survey reports and field data of brook trout (*Salvelinus fontinalis*) inventories made from 1974 to 1984 were examined to determine the current distribution in Tennessee. Brook trout currently inhabit 275.6 kilometers in 135 streams of eight east Tennessee counties. Brook trout occur allopatrically in 195.7 kilometers and sympatrically with rainbow trout (*Salmo gairdneri*), and in some cases brown trout (*Salmo trutta*), in another 79.9 kilometers. Thirty-two previously undocumented streams were found to have brook trout populations. Tennessee brook trout are generally found in small headwater streams above 925 meters elevation. These streams usually have soft water, low fertility, and are slightly acidic. Adult brook trout (>100mm) collected in 1974-1984 from 41 streams had an overall mean total length of 151.5mm, weight of 45.5g, and condition factor (K) of 1.12.

Brook trout now occupy 20 to 30% of their estimated range in 1900. Habitat degradation from development projects, logging, forest fires, unregulated harvest, and introduction of exotic salmonid species have severely reduced the brook trout's range. Most of the loss probably occurred in the early 1900's, but recent surveys demonstrate that the process is ongoing. Current losses of brook trout populations are attributed mainly to the encroachment of rainbow trout as well as stream degradation. Only 33% of the current brook

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

86-000753 CONTINUED trout streams are known ot have waterfall barriers that restrict the upstream movement of rainbow trout.

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[Dep. Biol. Sci., East. Ky. Univ., Richmond, KY 40475] The aquatic gastropod and fish faunas of the Interior Low Plateau of extreme southern Indiana, Illinois (Wabash River drainage), Kentucky, Tennessee, and northern Alabama reflect the interaction of tectonic changes, glaciation, eustatic stream modifications, piracy within the Low Plateau and in extralimital drainages (particularly the Coosa-Alabama system), immigration from trans-Mississippian systems, speciation within drainages that cross the Low Plateau, and survivorship as relicts. Examples in the Pleuroceridae, Unionidae, and several fish families are discussed, with emphasis on percid darters and the catfish genus *Noturus*.

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[Ky. Nat. Preserves Comm., Frankfort 40601]

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ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

86-000787 Abalmazova, M. G. [PHYSICAL FACTORS AFFECTING FISH CONCENTRATIONS FORMATION.] *In: Conditions of Formation of Commercial Fish Concentrations. Proc. All-Union Res. Inst. Mar. Fish. Oceanogr.* p. 116-126. 1984. In Russian with English summ. FR 31(1)

86-000788 Armor, C. and P. L. Herrgesell. DISTRIBUTION AND ABUNDANCE OF FISHES IN THE SAN FRANCISCO BAY ESTUARY BETWEEN 1980 AND 1982. *Hydrobiologia* 129:211-227. 1985. FR 31(1)
[Calif. Dep. Fish Game Bay-Delta Fish Proj., 4001 N. Wilson Way, Stockton, CA 95205]

86-000789 Beacham, T. D. and C. B. Murray. EFFECT OF FEMALE SIZE, EGG SIZE, AND WATER TEMPERATURE ON DEVELOPMENTAL BIOLOGY OF CHUM SALMON *(ONCORHYNCHUS KETA)* FROM THE NITINAT RIVER, BRITISH COLUMBIA. *Can. J. Fish. Aquatic Sci.* 42(11):1755-1765. 1985. In English with French summ. FR 31(1)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

86-000790 Brandt, S. B. and R. E. Demuth. CRITICAL FACTORS AFFECTING WINTER SURVIVAL OF THE ALEWIFE IN THE GREAT LAKES. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:30. 1985. Abstract only. FR 31(1)
[Coll. Environ. Sci. For., State Univ. N.Y., Syracuse 13126] Winter is a critical time for the alewife (*Alosa pseudoharengus*) in the Great Lakes. This species normally experiences a winter-spring mortality that varies significantly in intensity from year to year. We have used a bioenergetics model, developed at the University of Wisconsin, to evaluate the relative contribution of density independent and density dependent factors on individual alewife growth and, by inference, the probability of an individual's survival during the winter. The model assumes that the total amount of energy that is used in growth, locomotion and other physiological functions must equal the amount of energy consumed. Laboratory estimates of physiological parameters along with assumed winter environmental regimes

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86-000790 CONTINUED supply the input to the model. Primary variables considered are winter duration, temperature regime throughout the winter, condition of the alewife in the fall, food quality and food availability. We conclude that for the alewife in the Great Lakes, winter is a stressful period, the severity of which is determined by both abiotic and biotic factors. We suggest that the extent of the annual winter-spring dieoff may depend on several interrelated factors: alewife condition in the fall, alewife population size, and winter severity.

86-000791 Bryantsev, V. A.; P. D. Lomakin and V. B. Frimer. [CONDITIONS OF FORMATION OF *NOTOTHENIA SQUAMIFRONS* CONCENTRATIONS OVER THE OB' AND LENA BANKS IN THE ANTARCTIC.] *In: Conditions of Formation of Commercial Fish Concentrations. Proc. All-Union Res. Inst. Mar. Fish. Oceanogr.* p. 166-174. 1984. In Russian with English summ. FR 31(1)

86-000792 Courtenay, W. R., Jr.; J. E. Deacon; D. W. Sada; R. C. Allan and G. L. Vinyard. COMPARATIVE STATUS OF FISHES ALONG THE COURSE OF THE PLUVIAL WHITE RIVER, NEVADA. *Southwest. Nat.* 30(4):503-524. 1985. FR 31(1)
[Dep. Biol. Sci., Fla. Atl. Univ., Boca Raton, FL 33431-0991]

86-000793 Crecco, V. A. and T. F. Savoy. EFFECTS OF BIOTIC AND ABIOTIC FACTORS ON GROWTH AND RELATIVE SURVIVAL OF YOUNG AMERICAN SHAD, *ALOSA SAPIDISSIMA*, IN THE CONNECTICUT RIVER. *Can. J. Fish. Aquatic Sci.* 42(10):1640-1648. 1985. In English with French summ. FR 31(1)
[Dep. Environ. Prot., P.O. Box 248, Waterford, CT 06385]

86-000794 Darnitskij, V. B.; V. L. Boldyrev and A. F. Volkov. [ENVIRONMENTAL CONDITIONS AND SOME ECOLOGICAL CHARACTERISTICS OF FISHES FROM THE CENTRAL NORTH PACIFIC SEAMOUNTS.] *In: Conditions of Formation of Commercial Fish Concentrations. Proc. All-Union Res. Inst. Mar. Fish. Oceanogr.* p. 64-77. 1984. In Russian with English summ. FR 31(1)

86-000795 Gamble, J. C.; P. MacLachlan and D. D. Seaton. COMPARATIVE GROWTH AND DEVELOPMENT OF AUTUMN AND SPRING SPAWNED ATLANTIC HERRING LARVAE REARED IN LARGE ENCLOSED ECOSYSTEMS. *Mar. Ecol. Prog. Ser.* 26(1-2):19-33. 1985. FR 31(1)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen, Scotland] Populations of Atlantic herring larvae *Clupea harengus harengus* L. were reared in 300 m^3 *in situ* plastic enclosures for about 60 d in Sep to Nov 1978 and for about 90 d in Apr to Jul 1980. The addition of soluble organic effluent from North Sea oil production had little direct effect on the larvae in 1980 and, in 1978, it was difficult to discern effects due to the inadvertent trapping of juvenile fish predators. Developmental progression of the enclosed populations of larvae, as defined by morphological staging, differed between seasons. While developmental rate was undoubtedly correlated with growth rate, initial size of larvae (0.067 mg in autumn 1978 and 0.138 mg in 1980) had a significant effect on early development. It is suggested that the small egg size of the Minch autumn spawned herring serves to delay the developmental rate of the larva at a time when temperature and food conditions could stimulate rapid growth. This mechanism helps to ensure that larvae which hatch in September do not metamorphose before the onset of winter. In contrast the large egg and hatching larva of the Clyde spring spawner favours rapid progression through the developmental stages to early metamorphosis.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

86-000796 Glova, G. J.; M. L. Bonnett and C. R. Docherty. COMPARISON OF FISH POPULATIONS IN RIFFLES OF THREE BRAIDED RIVERS OF CANTERBURY, NEW ZEALAND. *N.Z. J. Mar. Freshwater Res.* 19(2):157-165. 1985. FR 31(1)

[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 8324, Riccarton, New Zealand] Populations of small fish were sampled in 12-20 riffles of the lower reaches of 3 braided rivers in Canterbury, New Zealand, during periods of low, stable flows. In the Ashley, which has been least affected by floods in recent years, the standing stock of fish was severalfold higher than in the Hurunui and Rakaia Rivers, which experienced large floods over much of the time, particularly the Rakaia River. Mean abundance ±1 standard deviation (S.D.) of all species combined, amounted to 5.95 ± 2.76 fish m^{-2} for 10 species in the Ashley, 0.59 ± 0.60 fish m^{-2} for 7 species in the Hurunui, and 0.23 ± 0.11 fish m^{-2} for 6 species in the Rakaia. Mean biomass was 24.85 ± 9.59, 2.11 ± 1.19, and 2.50 ± 3.60 g m^{-2} in the Ashley, Hurunui, and Rakaia Rivers, respectively. The more common species in the Ashley and Rakaia Rivers were torrentfish, longfinned eel, bluegilled bully, and upland bully. The same dominant species complex prevailed in the Hurunui River except that the common river galaxias was present instead of the bluegilled bully. The adverse effects of floods on fish, either directly, indirectly, or both, are considered to be a major limiting factor of fish populations in braided rivers charcterised by highly unstable flows and river beds, and a lack of suitable cover for fish.

86-000797 Hewitt, R. P.; G. H. Theilacker and N. C. H. Lo. CAUSES OF MORTALITY IN YOUNG JACK MACKEREL. *Mar. Ecol. Prog. Ser.* 26(1-2):1-10. 1985. FR 31(1)

[NMFS, P.O. Box 271, La Jolla, CA 92038] Field and laboratory experiments were conducted with the purpose of partitioning jack mackerel *Trachurus symmetricus* larval mortality into portions due to starvation and to predation. Field collections were made to determine larval condition, growth net retention and production; laboratory experiments were conducted to determine growth and body shrinkage due to preservation treatment. Age-specific starvation and total mortality rates were estimated and predation was inferred as the difference between the two. In the offshore oligotrophic part of the spawning habitat, larvae suffered a high rate of mortality which rapidly declined as they developed. Predation was the major source of mortality of yolk-sac larvae. As the yolks were absorbed and the larvae began to feed, starvation became a significant source of mortality. As the larvae further developed, starvation rapidly declined and predation again became the dominant source of mortality, although at a much lower rate.

86-000798 Layher, W. G. and O. E. Maughan. RELATIONS BETWEEN HABITAT VARIABLES AND CHANNEL CATFISH POPULATIONS IN PRAIRIE STREAMS. *Trans. Am. Fish. Soc.* 114(6):771-781. 1985. FR 31(1)

[Environ. Serv., Kans. Fish Game Comm., R.R. 2, Box 54A, Pratt 67124]

86-000799 McCauley, D. J.; L. T. Brooke and M. D. Balcer. ECOLOGICAL ASSESSMENT OF FACTORS AFFECTING WALLEYE OVA SURVIVAL IN THE LOWER FOX RIVER. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:54. 1985. Abstract only. FR 31(1)

[Univ. Wis., Superior 54880] Although adult walleyes (*Stizostedion v. vitreum*) currently inhabit the lower Fox River walleye recruitment failure in the river has been recognized. This study was designed to investigate ova mortality as a cause of recruitment failure. Described methods for in situ ova incubation, ova sampling, microstrata water sampling and chemical analyses were modified to delineate mortality caused by reduced water quality, growths of fungus, and egg predation. Notable differences in survival were evident when five ova incubation methods were compared to test their usefulness as walleye ova incubators. Water quality at the sediment/water interface was also noticeably different from that in the river channel water column.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

86-000800 McDonald, M. E.; L. B. Crowder and J. J. Magnuson. DENSITY CHANGES IN LAKE MICHIGAN FORAGE FISH POPULATIONS DURING AN ALEWIFE DECLINE. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:55. 1985. Abstract only. FR 31(1)

[Cent. Limnol., Univ. Wis., Madison 53706] The alewife population has recently declined to possibly its lowest level in the last 20 years. As the alewife declined the density of most other forage fishes increased. The most dramatic increases occurred in the nearshore yellow perch population (100X) and in the offshore bloater population (10X). Growth of these species appears to be decreasing, perhaps due to intraspecific competition at these high densities. If salmonids do not switch to foraging on these two species, we expect that large densities of relatively small perch and bloaters will develop and depress the abundance of the inshore zooplankton and offshore benthos.

86-000801 Morrison, P. F.; J. F. Leatherland and R. A. Sonstegard. COMPARATIVE FECUNDITY AND EGG SURVIVAL OF COHO SALMON (*ONCORHYNCHUS KISUTCH* WALBAUM) FROM LAKES ONTARIO, ERIE, AND MICHIGAN. *Can. J. Zool.* 63(5):1096-1100. 1985. In English with French summ. FR 31(1)

[J.F. Leatherland: Dep. Zool., Univ. Guelph, Guelph ON N1G 2W1, Canada]

86-000802 Nunan, C. P. and D. L. G. Noakes. RESPONSE OF RAINBOW TROUT (*SALMO GAIRDNERI*) EMBRYOS TO CURRENT FLOW IN SIMULATED SUBSTRATES. *Can. J. Zool.* 63(8):1813-1815. 1985. In English with French summ. FR 31(1)

[Dep. Zool. Group Advancement Fish Stud., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Direction of current flow did not affect the movement patterns of rainbow trout embryos maintained in artificial substrate systems. Embryos successfully emerged from the substrate in total darkness, although light has previously been implicated as necessary for emergent behaviour. Neither phototactic or rheotactic behaviour appears necessary for "normal" movement and emergence behaviour. Movement patterns appear to be primarily due to geotactic-geokinetic behaviour.

86-000803 Present, T. M. C. POPULATION DIFFERENCES IN ENERGY UTILIZATION IN GROWTH AND REPRODUCTION IN THE MARINE SHORE FISH, *HYPSOBLENNIUS JENKINSI*. *Am. Zool.* 25(4):105A. 1985. Abstract only. FR 31(1)

[Scripps Inst. Oceanol., La Jolla, CA]

86-000804 Rice, J. A. MECHANISMS REGULATING SURVIVAL OF LARVAL BLOATER *COREGONUS HOYI* IN LAKE MICHIGAN. *Ph.D. dissertation, Univ. Wis.* 232p. 1985. From Diss. Abstr. Int. B Sci. Eng. 46(4):1046. 1985. FR 31(1)

This thesis combines laboratory experiments, field sampling and otolith analysis to examine mechanisms regulating survival of Lake Michigan bloater larvae. Laboratory experiments showed that otolith ring deposition begins at first feeding in bloaters and occurs daily at all but the lowest growth rates. Short periods of starvation or low ration cause deposition of abnormally low contrast otolith rings. Statistical power was calculated to critically evaluate the assumption of daily ring deposition in otolith validation regressions, and confidence limit of age and growth rate estimates derived from otolith analysis were evaluated. Bloater larvae showed no evidence of a point of irreversible starvation; 50% of starved larvae survived 25 d, and larvae would still readily first feed after 30 d of starvation. Bloaters began swimming immediately after hatching and starved larvae were still swimming continuously at 0.9 cm/s after 21 d. Both fed and starved bloater larvae were captured with about 80% success by larger bloaters and alewives *Alosa pseudoharengus*; smaller larvae were slightly less susceptible than larger larvae. Year-to-year variation in survival of bloaters in Lake Michigan may be strongly affected by events occurring between spawning and about one month after hatching;

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86-000804 CONTINUED 1983 larval recruitment was 2.4 times greater than in 1982 through 1983 egg deposition was only 57% of that in 1982. High growth rates in the field and resistance to starvation in the laboratory show direct starvation effects were probably not an important factor. Otolith analysis showed that larvae hatching early had lower growth rates during the first few weeks of life, and were more likely to have experienced short periods of nutritional stress than were late hatching larvae. These early larvae also experienced higher mortality suggesting that size dependent or growth rate dependent predation may be important in survival. Seasonal variation in predator abundance is consistent with this hypothesis. Cooler temperatures in 1982 increased incubation time, prolonging egg exposure to predators which may account for the observed survival variation between years. These results suggest that the period from spawning through the first month of life is critical to bloater survival and support predation as the likely mechanism affecting larval bloater survival and recruitment success.

86-000805 Rice, J. A. MECHANISMS REGULATING SURVIVAL OF LARVAL BLOATER IN LAKE MICHIGAN. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:60. 1985. Abstract only. FR 31(1)
[Dep. Zool., N.C. State Univ., Raleigh 27695]

86-000806 Risotto, S. P. and R. E. Turner. ANNUAL FLUCTUATION IN ABUNDANCE OF THE COMMERCIAL FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES. *N. Am. J. Fish Manage.* 5(4):557-574. 1985. FR 31(1)
[R. E. Turner: Cent. Wetland Resour., La. State Univ., Baton Rouge 70803]

86-000807 Sowden, T. K. and G. Power. PREDICTION OF RAINBOW TROUT EMBRYO SURVIVAL IN RELATION TO GROUNDWATER SEEPAGE AND PARTICLE SIZE OF SPAWNING SUBSTRATES. *Trans. Am. Fish. Soc.* 114(6):804-812. 1985. FR 31(1)
[Dep. Biol., Univ. Waterloo, Waterloo, ON N2L 3G1, Canada]

86-000808 Timola, O. and T. Valtonen. EXPERIMENTAL STUDIES ON THE MORTALITY OF THE EGGS OF AUTUMN-SPAWNING FISH IN THE SEA-AREA OFF OULU. *Acta Univ. Ouluensis Sec. A Sci. Rev. Nat.* No. 42. Biol. No. 3. p. 45-54. 1976. FR 31(1)
[Perämeri Res. Stn., Univ. Culu, Oulu, Finland]

86-000809 Van der Veer, H. W. IMPACT OF COELENTERATE PREDATION ON LARVAL PLAICE *PLEURONECTES PLATESSA* AND FLOUNDER *PLATICHTHYS FLESUS* STOCK IN THE WESTERN WADDEN SEA. *Mar. Ecol. Prog. Ser.* 25(3):229-238. 1985. FR 31(1)
[Neth. Inst. Sea Res., P.O. Box 59, 1790 AB Den Burg, Texel, Netherlands]

86-000810 Veloso F., C. and A. Arrizaga M. [EL NIÑO AND THE SARDINE *CLUPEA (STRANGOMERA) BENTINCKI* FISHERY OF TALCAHUANO.] *Inst. Fom. Pesq. Invest. Pesq.* 32:185-190. 1985. In Spanish with English summ. FR 31(1):
[Dep. Biol. Tecnol. Mar., Pont. Univ. Catol. Chile, Sede Talcahuano, Casilla 127, Talcahuano, Chile]

86-000811 Williams, J. E. and D. W. Sada. STATUS OF TWO ENDANGERED FISHES, *CYPRINODON NEVADENSIS MIONECTES* AND *RHINICHTHYS OSCULUS NEVADENSIS*, FROM TWO SPRINGS IN ASH MEADOWS, NEVADA. *Southwest. Nat.* 30(4):475-484. 1985. FR 31(1)
[U.S. FWS, 2800 Cottage Way, Room E-1823, Sacramento, CA 95825]

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86-000812 Zijlstra, J. J. and J. I. Witte. ON THE RECRUITMENT OF O-GROUP PLAICE IN THE NORTH SEA. *Neth. J. Zool.* 35(1-2):360-376. 1985. FR 31(1)
[Neth. Inst. Sea Res., PB 59, 1790 AB Den Burg, Texel, Netherlands]

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86-000813 Aguilera, O.; O. D. Solano and J. Valdez. A NEW SPECIES OF FISH OF THE GENUS *STELLIFER* (PERCIFORMES: SCIAENIIDAE) FROM THE SOUTH CARIBBEAN SEA. *An. Inst. Invest. Mar. Punta de Betin* 13:5-16. 1983. In English with Spanish summ. FR 31(1)
[Univ. Nac. Exp., Francisco de Miranda, Coro, Venezuela]

86-000814 Bannikov, A. F.; N. V. Parin and J. Pinna. *RHAMPHEXOCOETUS VOLANS*, GEN. ET SP. NOV. A NEW BELONIFORM FISH (BELONIFORMES, EXOCOETOIDEI) FROM THE LOWER EOCENE OF ITALY. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 25(2):150-155. 1985. FR 31(1)
[Paleontol. Inst., AN USSR, Moscow, USSR]

86-000815 Barnes, L. A LATE MIOCENE MARINE VERTEBRATE ASSEMBLAGE FROM SOUTHERN CALIFORNIA. *Natl. Geogr. Soc. Res. Rep.* 21:13-20. 1985. FR 31(1)
[Nat. Hist. Mus. Los Angeles Cty., Los Angeles, CA]

86-000816 Caruso, J. H. THE SYSTEMATICS AND DISTRIBUTION OF THE LOPHIID ANGLERFISHES: III. INTERGENERIC RELATIONSHIPS. *Copeia* 1985(4):870-875. 1985. FR 31(1)
[7815 Dominican, New Orleans, LA 70118]

86-000817 Chapleau, F. and F. Pageau. MORPHOLOGICAL DIFFERENTIATION OF *ETHEOSTOMA OLMSTEDI* AND *E. NIGRUM* (PISCES: PERCIDAE) IN CANADA. *Copeia* 1985(4):855-865. 1985. FR 31(1)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada]

86-000818 Enseenko, S. A. A NEW GENUS AND SPECIES OF LEFTEYE FLOUNDER, *PSEUDOMANCOPSETTA ANDRIASHEVI*, AND THEIR POSITION IN THE SUBORDER PLEURONECTOIDEI. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 25(1):1-10. 1985. FR 31(1)
[Inst. Oceanol., Acad. Sci. USSR--IOAN, Moscow, USSR]

86-000819 Fink, W. L. and R. R. Miller. *CHEIRODON ARNOLDI*, A SENIOR SYNONYM OF *CHEIRODON AFFINIS*, A COMMON PANAMANIAN CHARACID FISH (TELEOSTEI, OSTARIOPHYSI). *Copeia* 1985(4):1058-1060. 1985. FR 31(1)
[Mus. Zool., Univ. Mich., Ann Arbor 48109]

86-000820 Grande, L. FISH FOSSILS IN THE EOCENE GREEN RIVER FORMATION OF SOUTHWESTERN WYOMING. *Natl. Geogr. Soc. Res. Rep.* 21:201-205. 1985. FR 31(1)
[Dep. Ichthyol., Am. Mus. Nat. Hist., New York, NY]

86-000821 Hardy, G. S. A NEW SPECIES OF CATSHARK IN THE GENUS *PARMATURUS* GARMAN (SCYLIORHINIDAE), FROM NEW ZEALAND. *N.Z. J. Zool.* 12(1):119-124. 1985. FR 31(1)
[Natl. Mus. N.Z., PB, Wellington, New Zealand]

IDENTIFICATION, KEYS, CLASSIFICATION (CONTINUED)

86-000822 Hardy, G. S. REVISION OF THE ACANTHOCLINIDAE (PISCES: PERCIFORMES), WITH DESCRIPTIONS OF A NEW GENUS AND FIVE NEW SPECIES. *N.Z.J. Zool.* 11(4):357-393. 1984. FR 31(1)
[Natl. Mus. N.Z., P.B., Wellington, New Zealand]

86-000823 Hensley, D. A. *EPTATRETUS MENDOZAI*, A NEW SPECIES OF HAGFISH (MYXINIDAE) FROM OFF THE SOUTHWEST COAST OF PUERTO RICO. *Copeia* 1985(4):865-869. 1985. FR 31(1)
[Dep. Mar. Sci., Univ. Puerto Rico, Mayaguez 00708]

86-000824 Jones, G. REVISION OF THE AUSTRALIAN SPECIES OF THE FISH FAMILY LEIOGNATHIDAE. *Aust. J. Mar. Freshwater Res.* 36(4):559-613. 1985. FR 31(1)
[Div. Fish. Res., CSIRO Mar. Lab., G.P.O. Box 1538, Tasmania 7001, Australia]

86-000825 Kobylyanskiy, S. G. MATERIAL FOR THE REVISION OF THE GENUS *BATHYLAGUS* GUNTHER (BATHYLAGIDAE): THE GROUP OF "LIGHT" DEEPSEA SMELTS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 25(2):1-17. 1985. FR 31(1)
[IOAN, Moscow, USSR]

86-000826 Krupp, F. *BARBUS CHANTREI* (SAUVAGE 1882), A VALID SPECIES OF CYPRINID FISH FROM THE NORTHERN LEVANT. (PISCES: OSTEICHTHYES: CYPRINIDAE). *Senckenbergiana Biol.* 66(1-3):17-25. 1985. FR 31(1)
[Inst. Zool., Johannes-Gutenberg-Univ., Saarstr. 21, D-6500 Mainz, West Germany]

86-000827 Krupp, F. A NEW SPECIES OF *CHONDROSTOMA* FROM THE ORONTES RIVER DRAINAGE BASIN OF TURKEY AND SYRIA. (PISCES: OSTEICHTHYES: CYPRINIDAE). *Senkenbergiana Biol.* 66(1-3):27-33. 1985. FR 31(1)
[Inst. Zool., Johannes-Gutenberg-Univ., Saarstr. 21, D-6500 Mainz, West Germany]

86-000828 Lal Mohan, R. S. SYSTEMATIC POSITION OF THE SCIAENID *CORVINA CAROUNA* CUVIER 1830. *Indian J. Fish.* 31(3):374-377. 1984. FR 31(1)
[CMFR Inst., Cochin, India]

86-000829 McEachran, J. D. and R. E. Matheson, Jr. POLYCHROMATISM AND POLYMORPHISM IN *BREVIRAJA SPINOSA* (ELASMOBRANCHII, RAJIFORMES), WITH DESCRIPTION OF THREE NEW SPECIES. *Copeia* 1985(4):1035-1052. 1985. FR 31(1)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

86-000830 Meisler, M. R. *SERRANUS LAMPRURUS* JORDAN AND GILBERT, 1882 (PISCES: SERRANIDAE), A JUNIOR SYNONYM OF *LUTJANUS ARGENTIVENTRIS* (PETERS, 1869) (PISCES: LUTJANIDAE). *Copeia* 1985(4):1064-1066. 1985. FR 31(1)
[Sect. Ichthyol., Nat. Hist. Mus., Los Angleles Cty., 900 Exposition Blvd., Los Angeles, CA 90007]

86-000831 Pezold, F. L. A REVISION OF THE GOBIOID FISH GENUS *GOBIONELLUS*. *Ph.D. dissertation, Univ. Tex.* 443p. 1984. From Diss. Abstr. Int. B Sci. Eng. 46(4):1086. 1985. FR 31(1)

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86-000832 Platts, W. S. and R. L. Nelson. POPULATION FLUCTUATIONS AND GENERIC DIFFERENTIATION IN THE HUMBOLDT CUTTHROAT TROUT OF GANCE CREEK, NEVADA. *Cal-Neva Wildl. Trans.* 1983:15-19. 1983. FR 31(1)
[U.S. For. Serv., For. Sci. Lab., Boise, ID 83702] Dramatic fluctuations in weights, lengths, numbers, and condition of a native population of cutthroat trout in Gance Creek, Elko County, Nevada, are described. Such fluctuations and ability to survive under a highly changeable environment are presented as ecological evidence for taxonomists to consider in possibly separating the lahontan basin native cutthroat trout into two subspecific taxa: Lahontan and Humboldt cutthroat trout.

86-000833 Robins, C. R. and H. W. Robison. *COTTUS HYPSELURUS*, A NEW COTTID FISH FROM THE OZARK UPLANDS, ARKANSAS AND MISSOURI. *Am. Midl. Nat.* 114(2):360-373. 1985. FR 31(1)
[Rosenstiel Sch. Mar. Atmos. Sci., Univ. Miami, Miami, FL 33149]

86-000834 Rosa, R. S. A SYSTEMATIC REVISION OF THE SOUTH AMERICAN FRESHWATER STINGRAYS (CHONDRICHTHYES: POTAMOTRYGONIDAE). *Ph.D. dissertation, Coll. William and Mary in Va.* From Diss. Abstr. Int. B Sci. Eng. 46(6):1843. 1985. FR 31(1)

86-000835 Salmela, R. SIGNIFICANCE OF THE MAXILLARY AND SUPRAMAXILLARY BONES IN THE IDENTIFICATION OF *COREGONUS LAVARETUS* (L.) AND *COREGONUS NASUS* (PALLAS), SENSU SVARDSON, IN THE BOTHNIAN BAY. *Bothnian Bay Rep.* 2:35-40. 1980. FR 31(1)
[Perämeri Res. Stn., Univ. Oulu, SF-90100 Oulu 10, Finland]

86-000836 Selezneva, A. A. INTENSIFICATION OF RESPIRATION AS A BASIS FOR EVOLUTIONARY DEVELOPMENT OF ACTINOPTERYGII. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 25(1):100-109. 1985. FR 31(1)
[USSR-PIN, Moscow, USSR]

86-000837 Tsarev, Y. T.; A. A. Kogatnykh, V. A. Gorshkov; V. A. Maksimov and B. M. Mednikov. RELATIONSHIP OF PACIFIC SALMONS OF THE GENUS *ONCORHYNCHUS*. *Dokl. Biol. Sci.* 279(1-6):764-765. 1985. FR 31(1)
[Moscow State Univ., Moscow, USSR]

86-000838 Valtonen, T. IDENTIFICATION OF WHITEFISH SPECIMENS IN THE BOTHNIAN BAY. *Acta Univ. Ouluensis Sec. A Sci. Rev. Nat.* No. 42. Biol. No. 3. p. 113-119. 1976. FR 31(1)
[Perämeri Res. Stn., Univ. Oulu, Oulu, Finland]

86-000839 Vari, R. P. and M. Goulding. A NEW SPECIES OF *BIVIBRANCHIA* (PISCES: CHARACIFORMES) FROM THE AMAZON RIVER BASIN. *Proc. Biol. Soc. Wash.* 98(4):1054-1061. 1985. FR 31(1)
[Dep. Vert. Zool., Natl. Mus. Nat. Hist., Smithsonian Inst., Washington, DC 20560]

86-000840 Weitzmar, M. *HYPHESSOBRYCON ELACHYS*, A NEW MINIATURE CHARACID FROM EASTERN PARAGUAY (PISCES: CHARACIFORMES). *Proc. Biol. Soc. Wash.* 98(4):799-808. 1985. FR 31(1)
[Dep. Vet. Zool., Natl. Mus. Nat. Hist., Smithsonian Inst., Washington, DC 20560]

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[Battelle, Pac. Northwest Lab., Richland, WA 99352] The tolerance of post-larval and fingerling sea bass, *Dicentrarchus labrax* and striped mullet, *Mugil cephalus*, to gas supersaturated seawater was evaluated, along with the influence of seawater temperature on the tolerance of post-larval sea bass to gas supersaturation. The 96 h LC_{50} values for post-larvae of the two species tested at 20°C were similar: 127.2% TGP (125.2-129.4% TGP) for sea bass and 129.4% TGP (124.7-135.0% TGP) for striped mullet. The 96 h LC_{50} values for fingerlings tested at 20°C were 116.0% TGP (112.0-124.2% TGP) for sea bass and 124.8% TGP (121.4-127.2% TGP) for striped mullet. For both species, fingerlings were less tolerant of supersaturated sea-water than were post-larvae. Post-larval sea bass were less tolerant of gas supersaturated water at 26°C than at 20°C.

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[U.S. FWS, Natl. Fish Health Res. Lab., Kearneysville, WV 25430]

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Rainbow trout (*Salmo gairdneri*) held in the laboratory were subjected to sea lamprey (*Petromyzon marinus*) attack for prescribed time periods. Blood and hemopoietic tissue samples taken during wound development and wound healing provided information on the hosts' ability to recover after a lamprey attack. The blood features that were monitored included the hematocrit, hemoglobin, red blood cell precursors, leucocrit, and leucocyte differential. The spleen was the only hemopoietic organ which exhibited pathological change. During lamprey attachment the hematocrit and hemoglobin values for host fish were higher than for control fish, which was attributed in part to a stress response and the inability of the smaller sized lamprey (19.1 cm and 13.5g) to induce anemia. There was no significant change in the red

OTHER DISEASES AND PARASITES (CONTINUED)

86-000919 CONTINUED blood cell precursors during this wound development period, and host fish demonstrated lymphopenia with concomitant neutrophilia. The hematocrit and hemoglobin values for fish in the wound healing group dropped significantly at 2 days following lamprey detachment, which is believed to be attributed to hemodilution via the wound area. The number of red blood cell precursors rose significantly during wound healing and reached a peak value at 1 month. Lymphopenia with concomitant neutrophilia was evident 2 days following lamprey detachment.

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[West. Reg., Dep. Fish. Oceans, Winnipeg, MB R3T 2N6, Canada] A population of the white sucker, *Catostomus commersoni*, in Lake 223, in the Experimental Lakes Area, northwestern Ontario was studied from 1975 until 1983 to monitor the responses of the fish to experimental acidification of the lake. Recruitment failures occurred in 1981, 1982 and 1983 when pH of the lake was between 5.0-5.2. Normal recruitment occurred in this lake in all other years from 1971-1980 when pH was between 5.6-6.5, and in other non-acidic lakes in this area during 1971-1983.

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86-000944 CONTINUED Growth of fish aged two to six years increased as lake pH decreased from 6.5-5.5. Condition factors of all fish initially increased. These increases in growth and condition were made possible by increasing food supplies. By 1981-1982, when Lake 223's pH was 5.02, a decrease in food supply coincident with a peak in abundance of white suckers led to a decline in condition factors and a slight decline in growth of fish aged two to six years. Lowest condition factors occurred in 1983.

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[Rochester Gas Elec. Co., 89 East Ave., Rochester, NY 14649] This study is another phase of a program to explore the cold-shock phenomenon as it relates to RG&E on Lake Ontario. In the lab, fingerling rainbow trout were acclimated to 10°C or 15°C and then immediately transferred into water temperatures of 0.5°, 1.0°, 2.0°, or 3.0°C where they were held for a minimum of 96 hours and observed for survival. Only the 15° to 0.5°C test resulted in mortalities, with 60% of these fish dead at the end of 96 hours. In similar studies previously reported in the literature, 96 hour TL_m values for 15°C and 10°C acclimated fish were 1.4°C and ~0.5°C, respectively. In the present study 96 hour TL_m for 15°C would be slightly above 0.5°C but less than 1.0°C, and for 10°C would be below 0.5°C. Previous field studies on adult rainbow trout showed no mortalities for fish acclimated in the 11°-14°C range and placed in 0.5°C-0.6°C water. The present study supports the field results since the ranges of thermal tolerances found in both these studies are similar and generally lower than those reported in the literature. A major portion of the study results are demonstrated through the presentation of a video-tape of fish responses made during the lab tests.

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[Dep. Environ. Sci. Eng., Fla. Inst. Technol., Melbourne, FL 32901]

86-000966 Simmons, R. C. EFFECTS OF PLACER MINING SEDIMENTATION ON ARCTIC GRAYLING OF INTERIOR ALASKA. *M.S. thesis, Univ. Alaska* 75p. 1984. FR 31(1)
During summer 1982 and 1983, I assessed the effects of placer mining sedimentation on Arctic grayling, *Thmallus arcticus*, in the headwaters of the Birch Creek and Chatanika River drainages, northeast of Fairbanks, Alaska. In each drainage I compared the differences between two streams near their confluence, one that was undisturbed and one with mining activity upstream. Although many age-0 and adult grayling used unmined streams for summer habitat, I found no grayling in the mined streams except during periods of migration. Apparently, grayling consistently chose clearwater streams for summer residence. Caged fish studies demonstrated that if grayling could not escape from streams carrying mining sediments, they would suffer direct, chronic effects, including gill damage, dietary deficiencies, and slowed maturation. The indirect effects of sedimentation on grayling populations, through loss of summer habitat for feeding and reproduction, are more severe than the direct ones.

86-000967 Skurdal, J.; T. Qvenild and O. K. Skogheim. MERCURY ACCUMULATION IN FIVE SPECIES OF FRESHWATER FISH IN LAKE TYRIFJORDEN, SOUTH-EAST NORWAY, WITH EMPHASIS ON THEIR SUITABILITY AS TEST ORGANISMS. *Environ. Biol. Fishes* 14(2-3):233-237. 1985. FR 31(1)
[Dep. Biol., Div. Zool., Univ. Oslo, P.O. Box 1050 Blindern, N-0316 Oslo 3, Norway]

86-000968 Suns, K.; G. Crawford and D. Russell. ORGANOCHLORINE AND MERCURY RESIDUES IN YOUNG-OF-THE-YEAR SPOTTAIL SHINERS FROM THE DETROIT RIVER, LAKE ST. CLAIR, AND LAKE ERIE. *J. Great Lakes Res*. 11(3):347-352. 1985.

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86-000968 CONTINUED FR 31(1)
[Water Resour. Br., Ontario Minist. Environ., P.O. Box 213, Rexdale, ON M9W 5L1, Canada]

86-000969 Theurer, F. D.; E. H. Seely and W. J. Miller. CONSERVATION FARMING AND AQUATIC RESOURCES. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 50:188-199. 1985. FR 31(1)
[U.S.D.A., S.C.S., c/o Hydro-Ecosyst. Res. Unit, P.O. Box E, Ft. Collins, CO 80522]

86-000970 Van Nieuwenhuyse, E. E. THE EFFECTS OF PLACER MINING ON THE PRIMARY PRODUCTIVITY OF INTERIOR ALASKA STREAMS. *M.S. thesis, Univ. Alaska* 120p. 1983. FR 31(1)

During the summers of 1982 and 1983 data on water quality, light, and gross primary productivity were collected for mined and unmined streams in the Birch Creek and Chatanika River drainages. All placer mined streams exhibited higher total residues, total iron, and total phosphorus concentrations, as well as increased turbidity and settleable solids levels. The relationship between stream light extinction coefficient and turbidity was described well (r^2 = 0.99) by the equation $N_t = 1.00 + 0.024(T)$, where N_t = total extinction coefficient (m^{-1}) and T = turbidity in nephelometric turbidity units (NTU). Productivity in undisturbed streams was positively correlated with incident photosynthetically active radiation and averaged 0.8 $g\text{-}O_2m^{-2}d^{-1}$. Mean productivity for a moderately mined stream in which settleable solids never exceeded 0.1 ml 1^{-1} was reduced approximately by half (at mean turbidities <200 NTU) while no primary production occurred in heavily mined streams displaying mean settleable solids levels >0.2 ml 1^{-1}. Short of total wastewater recycling, strict enforcement of a settleable solids standard of <0.1 ml 1^{-1} in the receiving waters is recommended as the best practical way to minimize the harmful effects of placer mining on primary production and additionally to help ensure a more rapid recovery of a stream ecosystem after mining has ceased.

86-000971 Vuorinen, P. J.; J. Paasivirta; T. Piilola; K. Surma-Aho and J. Tarhanen. ORGANOCHLORINE COMPOUNDS IN BALTIC SALMON AND TROUT. I. CHLORINATED HYDROCARBONS AND CHLOROPHENOLS 1982. *Chemosphere* 14(11-12):1729-1740. 1985. FR 31(1)
[Finnish Game Fish. Res. Inst., Fish. Div., Unioninkatu 45 B 42, SF 00170 Helsinki 17, Finland]

86-000972 Wagener, S. M. EFFECTS OF GOLD PLACER MINING ON STREAM MACROINVERTEBRATES OF INTERIOR ALASKA. *M.S. thesis, Univ. Alaska* 99p. 1984. FR 31(1)

Placer gold mining is an economically and politically important industry in Alaska which can have major impacts on the water quality of streams. To determine the effect of placer mining on benthic macroinvertebrates we determined water quality characteristics and sampled benthic invertebrates in nine hydrologically similar and proximally located streams. Sampled streams ranged from unmined control streams to heavily mined streams. Placer mining caused increases in turbidity, settleable solids, percent substrate embeddedness, nonfilterable residue, and total recoverable arsenic, lead, zinc, and copper. Placer mining decreased invertebrate density and biomass. Substrate embeddedness and turbidity were the best predictive descriptors of reduced invertebrate density and biomass. Invertebrate communities in mined streams usually contained higher proportions of collector-gatherers, and lower proportions of crawlers, shredders, filter-feeders, predators, and oligochaetes compared to unmined streams.

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[Group HSE-8, Environ. Surveillance, Los Alamos Natl. Lab. MS K490, P.O. Box 1663, Los Alamos, NM 87545]

86-000974 Whittle, D. M.; W. H. Hyatt and M. J. Keir. TRENDS IN CONTAMINANT BURDENS OF LAKE ONTARIO FISH. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:66. 1985. Abstract only. FR 31(1)
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86-000975 Zitko, V. and M. Woodside. CATIONIC SURFACTANTS IN MARINE FISH. *Mar. Pollut. Bull.* 16(9):364-365. 1985. FR 31(1)
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86-000976 Ippolito, D. F. A WINTER DIE OFF IN FAIRFIELD RESERVOIR (FREESTONE COUNTY, TEXAS), WITH SPECIAL EMPHASIS ON MORTALITY IN *SAROTHERODON AUREUS* (CICHLIDAE). *Southwest. Nat.* 30(3):456-459. 1985. FR 31(1)
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86-000977 Adams, S. M.; C. A. Burtis and J. J. Beauchamp. INTEGRATED AND INDIVIDUAL BIOCHEMICAL RESPONSES OF RAINBOW TROUT *(SALMO GAIRDNERI)* TO VARYING DURATIONS OF ACIDIFICATION STRESS. *Comp. Biochem. Physiol. C Comp. Pharmacol. Toxicol.* 82(2):301-310. 1985. FR 31(1)
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86-000978 Al-Sabti, K. CARCINOGENIC-MUTAGENIC CHEMICALS INDUCED CHROMOSOMAL ABERRATIONS IN THE KIDNEY CELLS OF THREE CYPRINIDS. *Comp. Biochem. Physiol. C Comp. Pharmacol. Toxicol.* 82(2):489-493. 1985. FR 31(1)

86-000979 Allard, M. and G. Moreau. SHORT-TERM EFFECT ON THE METABOLISM OF LOTIC BENTHIC COMMUNITIES FOLLOWING EXPERIMENTAL ACIDIFICATION. *Can. J. Fish. Aquatic Sci.* 42(10):1676-1680. 1985. In English with French summ. FR 31(1)
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86-000981 Asztalos, B. and J. Nemcsók. EFFECT OF PESTICIDES ON THE LDH ACTIVITY AND ISOENZYME PATTERN OF CARP (*CYPRINUS CARPIO* L.) SERA. *Comp. Biochem. Physiol. C Comp. Pharmacol. Toxicol.* 82(1):217-219. 1985.

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[Lab. Anim. Res. Cent., Rockefeller Univ., 1230 York Ave., New York, NY 10021]

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[Neth. Inst. Sea Res., P.O. Box 59, 1790 AB Den Burg, Texel, Netherlands]

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[Zool. Inst., Entwicklungsbiol., Berl. Str. 28, D-3400 Gottingen, West Germany]

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[Dep. Biol., McMaster Univ., Hamilton, ON L8S 4K1, Canada] Hard- and softwater acclimated adult rainbow trout were statically exposed to copper (12.5, 25, 50, 100, and 200 ppb) for two, 12 h periods at neutral and pH 5.0. Unidirectional Na^+ and Cl^-, and net Na^+, Cl^-, K^+, and ammonia fluxes were monitored as a measure of branchial ionoregulatory disturbance. Copper concentrations as low as 12.5 ppb led to measurable ion losses. Net Na^+, Cl^-, and K^+ losses were concentration dependent and unaffected by prior acclimation to either hard- or softwater at both neutral pH and pH 5. From 12.5 to 50 ppb net NaCl losses arose primarily as a result of the inhibition of J_{in}, and at higher concentrations, J_{out} was also stimulated. In softwater, J_{in} was more resistant to inhibition than in hardwater. However, in hardwater, J_{out} recovered to normal levels during the second 12 h period, but no such recovery was found in softwater. Plasma NaCl was inversely correlated with [copper], while plasma glucose and ammonia increased with [copper]. At pH 5.0 and [copper] from 12.5 to 50 ppb, H^+ contributed significantly to the total ion loss, while at 100 and 200 ppb, ion losses were no greater at pH 5.0

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[U.S. FWS, Natl. Fish Health Res. Lab., Kearneysville, WV] In laboratory research, the rainbow trout has become a counterpart to the white rat, because that fish is an adaptable species available in much of the developed world and stocks from egg through adult are available throughout the year. Moreover, many strains are recognized, and their propagation and laboratory maintenance are not particularly demanding. Also, knowledge of rainbow trout nutrition, husbandy, diseases, immune responses, toxicology, and carcinogenesis exceeds that of any other salmonid or coldwater teleost. The reainbow trout is the logical surrogate species in many studies of other salmonids.

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[Aquatic Systems Inc., P.O. Box 8301, La Jolla, CA 92038] The striped bass, *Morone saxatilis*, x white bass, *Morone chrysops*, hybrid was first created in 1965 as an effort to develop a fish with the desirable qualities of a striped bass, but with the added ability to reproduce and sustain its populations in inland lakes and reservoirs. While not successful in the latter respect, the hybrid striped bass has surpassed

RESEARCH AND MANAGEMENT-GENERAL (CONTINUED)

86-001052 CONTINUED its other expectations, exhibiting several improvements over its parental species. Anglers are enthusiastic about its recreational value while fishery managers have stocked it to provide controlled management of forage species such as threadfin shad. Recently the hybrid has been examined as a candidate for commercial aquaculture, and studies have shown excellent survival, growth, and production capabilities in several different culture environments.

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[Wis. Dep. Nat. Resour., Madison]

86-001064 Strickland, D. MANAGING WILDLIFE RESOURCES BY OBJECTIVE. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 50:296-303. 1985. FR 31(1)
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[Natural Heritage Section, Calif. Dep. Fish Game, 1416 Ninth St., Sacramento, CA 95814]

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86-001066 International Pacific Halibut Commission. INTERNATIONAL PACIFIC HALIBUT COMMISSION ANNUAL REPORT 1984. *Int. Pac. Halibut Comm. Annu. Rep.* 1984. 63p. 1985. FR 31(1)
[P.O. Box 95009, Seattle, WA 98145-2009]

HABITAT ALTERATIONS

86-001067 Alevizon, W. S.; J. C. Gorham; R. Richardson and S. A. McCarthy. USE OF MAN-MADE REEFS TO CONCENTRATE SNAPPER (LUTJANIDAE) AND GRUNTS (HAEMULIDAE) IN BAHAMIAN WATERS. *Bull. Mar. Sci.* 37(1):3-10. 1985. FR 31(1)
[Dep. Biol. Sci., Fla. Inst. Technol., Melbourne, FL 32901] The feasibility of using man-made reefs to concentrate populations of food fishes (Lutjanidae and Haemulidae) was investigated in Bahamian waters. Fourteen reef units, constructed of PVC pipe and concrete blocks, were installed in seagrass beds and sand bottom habitats at depths of 4-5m in July of 1982. The units were highly successful in attracting the target species, and appear to offer a promising method of substantially increasing the readily available protein supply for islanders throughout the Carribbean at a relatively low cost. Comparisons of the fish communities associated with natural patch reefs and man-made reefs in both habitats suggest that reef structure is subordinate to source of recruitment as a determinant of reef fish community structure.

86-001068 Alevras, R. A. and S. J. Edwards. USE OF REEF-LIKE STRUCTURES TO MITIGATE HABITAT LOSS IN AN ESTUARINE ENVIRONMENT. *Bull. Mar. Sci.* 37(1):396. 1985. Abstract only. FR 31(1)
[Lawler, Matusky and Skelly Eng., One Blue Hill Plaza, Pearl River, NY 10965]

86-001069 Bartone, S. A. and D. Van Orman. FACTORS CONTROLLING OPTIMAL BIOLOGICAL PROCUCTIVITY ON ARTIFICIAL REEFS. *Bull. Mar. Sci.* 37(1):396. 1985. Abstract only. FR 31(1)
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[Coop. Inst. Mar. Atmos. Sci., 4600 Rickenbacker Causeway, Miami, FL 33149]

86-001071 Brock, R. E. PRELIMINARY STUDY OF THE FEEDING HABITS OF PELAGIC FISH AROUND HAWAIIAN FISH AGGREGATION DEVICES OR CAN FISH AGGREGATION DEVICES ENHANCE LOCAL FISHERIES PRODUCTIVITY. *Bull. Mar. Sci.* 37(1):40-49. 1985. FR 31(1)
[Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe 96744]

86-001072 Bryant, L. D. LIVESTOCK MANAGEMENT IN THE RIPARIAN ECOSYSTEM. *U.S.D.A. For. Serv. Gen. Tech. Rep.* RM-120. p. 285-289. 1985. FR 31(1)
[U.S. For. Serv., Pac. Northwest For. Range Exp. Stn., La Grande, OR] Intensive, long-term livestock grazing has occurred along most streams in the western United States. Although most livestock grazing on public lands is now under some form of management, many riparian areas are below "good" in ecologic condition, with forage production considerably below potential. Eight years of research at Meadow Creek, Starkey Experimental Forest and Range, Wallowa-Whitman National Forest, in northeastern Oregon, indicates that herbage production was increased 1- to 4-fold through timing and intensity of grazing. Rest-rotation, deferred rotation, and season-long grazing systems were tested. Although there were no statistically different changes in plant composition, the production of both graminoids and forbs increased dramatically.

86-001073 Bryant, M. D. CHANGES 30 YEARS AFTER LOGGING IN LARGE WOODY DEBRIS AND ITS USE BY SALMONIDS. *U.S.D.A. For. Serv. Gen. Tech. Rep.* RM-120. p. 329-334. 1985. FR 31(1)
[U.S. For. Serv., For. Sci. Lab., Juneau, AK] Changes in large woody debris in fourth and fifth-order salmon streams with logged, unlogged, and partially logged riparian zones are documented from maps--for 1949 to 1960--and from field surveys done in 1983 and 1984. Over the 30-year period, most changes in the amount of large woody debris occurred in the logged systems. During and immediately after logging large increases were noted, but in 1984 the amount of large woody debris in the logged systems was less than that observed before logging in most categories. Amounts of large woody debris in the other streams remained relatively stable. Thirty years after logging, habitat formed as a result of large debris provides important rearing areas for juvenile salmonids. Results from this study emphasize the importance of managing riparian zones as a source of large organic debris.

86-001074 Buckley, R. M. and G. J. Hueckel. BIOLOGICAL PROCESSES AND ECOLOGICAL DEVELOPMENT ON AN ARTIFICIAL REEF IN PUGET SOUND, WASHINGTON. *Bull. Mar. Sci.* 37(1):50-69. 1985. FR 31(1)
[Wash. State Dep. Fish., Mar. Fish Proj., Rm. 115 Gen. Admin. Bldg., Olympia 98504] Research at the Gedney Island artificial reef complex examined sustained aggregation and production of recreationally important fishes, and the rate of biota development toward a natural temperate reef situation. Algal and invertebrate species diversity increased following starfish and nudibranch predation of the space dominating barnacles. Algae colonization was a major contributor to the physical structure of the reef, and increased colonization by small crustaceans. Fishes colonizing the reef structures were most likely itinerant in the surrounding environment, and initially aggregated for orientation and protective habitat. Fish community structure evolved to include both reef foragers and aggregators, as food items developed on the reef structures. Fish densities considerably greater than on expansive rocky reefs, resulted from the artificial reef "oasis" or "home base" effect in the otherwise featureless sand habitat. Simulated fishery removals of adult rockfish determined that a density of

HABITAT ALTERATIONS (CONTINUED)

86-001074 CONTINUED 0.104 fish/m^2 is sufficient to withstand actual and potential fishery removals. Monitoring for this rockfish threshold density appears to provide a workable technique for managing artificial reef fisheries in Puget Sound. Anglers fishing over the artificial reef retained 2.4 times more fish per hour than anglers fishing over nearby natural areas. The reef fishery appears to approximate an adult rockfish removal rate of 31%. Diet analysis indicated that increases in adult copper rockfish may be correlated to successional biota development on the reef structures, which provided alternative prey items when normal forage fish species were in cyclic low abundance. Quillback rockfish increases appear correlated with increased abundance of structure-oriented prey items following the proliferation of algal growth.

86-001075 Burchmore, J. J.; D. A. Pollard; J. D. Bell; M. J. Middleton; B. C. Pease and J. Matthews. AN ECOLOGICAL COMPARISON OF ARTIFICIAL AND NATURAL ROCKY REEF FISH COMMUNITIES IN BOTANY BAY, NEW SOUTH WALES, AUSTRALIA. *Bull. Mar. Sci.* 37(1):70-85. 1985. FR 31(1)
[Sch. Biol. Sci., Macquarie Univ., North Ryde, NSW 2113, Australia]

86-001076 Carter, J. W.; W. N. Jessee; M. S. Foster and A. L. Carpenter. MANAGEMENT OF ARTIFICIAL REEFS DESIGNED TO SUPPORT NATURAL COMMUNITIES. *Bull. Mar. Sci.* 37(1):114-128. 1985. FR 31(1)
[Lockheed-Georgia, Dep. 72-83; Zone 418, 86 A. Cobb Dr., Marietta, GA 30063]

86-001077 Carter, J. W.; A. L. Carpenter; M. S. Foster and W. M. Jessee. BENTHIC SUCCESSION ON AN ARTIFICIAL REEF DESIGNED TO SUPPORT A KELP-REEF COMMUNITY. *Bull. Mar. Sci.* 37(1):86-113. 1985. FR 31(1)
[Lockheed-Georgia, Dep. 72-83; Zone 418, 86 A. Cobb Dr., Marietta, GA 30063]

86-001078 Chandler, C. R.; R. M. Sanders, Jr. and A. M. Landry, Jr. EFFECTS OF THREE SUBSTRATE VARIABLES ON TWO ARTIFICIAL REEF FISH COMMUNITIES. *Bull. Mar. Sci.* 37(1):129-142. 1985. FR 31(1)
[LGL Ecol. Res. Assoc., 1410 Cavitt, Bryan, TX 77801]

86-001079 Chang, K. REVIEW OF ARTIFICIAL REEFS IN TAIWAN: EMPHASIZING SITE SELECTION AND EFFECTIVENESS. *Bull. Mar. Sci.* 37(1):143-150. 1985. FR 31(1)
[Inst. Zool., Acad. Sin., Nankang, Taipei, Taiwan, ROC] Nineteen artificial reefs were constructed in the coastal waters off Taiwan and Peng-hu Islands in the past decade. Systematic studies on the site selection, the configuration and construction materials of the reef blocks, the biological community succession on the artificial reefs, and the economic evaluation of the reef fisheries were performed, from which several conclusions were reached: (1) a preferable reef site is shielded from strong current, away from natural reefs, nad in waters not deeper than 30 m; (2) an effective artificial reef should always be constructed of long-lasting materials, established in collective piles, and provide enough shielding spaces for different sizes of fishes; and (3) modulated by surrounding environmental conditions. Two types of sessile organism communities were developed on artificial reefs, an autotrophic community dominated by algae and a heterotrophic one dominated by sessile invertebrates. The behavior of some fish species associated with artificial reefs is described. The effectiveness of artificial reefs for natural resources preservation, habitat reconstruction, and nursery of coastal water fisheries was confirmed.

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86-001080 Cornelius, S. D. and N. Kevern. IMPACT OF PHYSICAL PARAMETERS ON THE UTILIZATION OF THE MUSKEGON ARTIFICIAL REEF BY YELLOW PERCH. *Int. Assoc. Great Lakes Res. Conf. Great Lakes Res. Prog. Abstr.* 28:34. 1985. Abstract only. FR 31(1)
[Dep. Fish Wildl., Mich. State Univ., East Lansing 48824]

86-001081 Cushman, R. M. REVIEW OF ECOLOGICAL EFFECTS OF RAPIDLY VARYING FLOWS DOWNSTREAM FROM HYDROELECTRIC FACILITIES. *N. Am. J. Fish. Manage.* 5(3A):330-339. 1985. FR 31(1)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37831]

86-001082 De Young, B. R. A PROMISING MATERIAL TO IMPROVE FAD DURABILITY AND COST. *Bull. Mar. Sci.* 37(1):397. 1985. Abstract only. FR 31(1)
[N.Y. Sea Grant Ext. Prog., Cornell Univ. Lab., 39 Sound Ave., Riverhead, NY 11901]

86-001083 Downing, N.; R. A. Tubb; C. R. El-Zahr and R. E. McClure. ARTIFICIAL REEFS IN KUWAIT, NORTHERN ARABIAN GULF. *Bull. Mar. Sci.* 37(1):157-178. 1985. FR 31(1)
[Dep. Maricult. Fish., Kuwait Inst. Sci. Res., P.O. Box 1638, Salmuja, Kuwait]

86-001084 Duffy, J. M. ARTIFICIAL REEFS AS MITIGATION. A SMALL SCALE CASE HISTORY. *Bull. Mar. Sci.* 37(1):397. 1985. Abstract only. FR 31(1)
[Calif. Dep. Fish Game, 1350 Front St., San Diego, CA 92101]

86-001085 Feigenbaum, D.; C. H. Blair; M. Bell; J. R. Martin and M. G. Kelly. VIRGINIA'S ARTIFICIAL REEF STUDY: DESCRIPTION AND RESULTS OF YEAR I. *Bull. Mar. Sci.* 37(1):179-188. 1985. FR 31(1)
[Dep. Oceanogr., Old Dominican Univ., Norfolk, VA 23508] The 3-year Virginia artificial reef study began on 1 January 1983 with the aim of creating a master plan for reef development in Virginia's waters. In the first year, four types of benthic structures (high surface area tires--HST's; low surface area tires--LST's; concrete igloos; concrete pipe pyramids) were developed at two sites--Wachapreague and Cape Charles, Virginia. Evaluations of the structural integrity and effectiveness of these reefs were made by SCUBA observation and rod and reel fishing by the study team. All structures were in place by 7 July 1983. At Wachapreague, the highest catch rates over a 6-week period were obtained on the LST's (11.43 fish/rod-h) and HST's (10.01 f/rh). Concrete pipes also performed well (8.28 f/rh), but but the igloos (3.10 f/rh) seemed to protect fish from the anglers. All units performed better than the control station (1.04 f/rh). Results at Cape Charles were similar in terms of number of fish, but lower by weight because many of the fish were juveniles.

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Methods of improving accuracy and efficiency of creel census estimates were tested during the summers of 1979 and 1980 on the grayling (*Thymallus arcticus*) fishery of the upper Chena River. Roving counts of fisherman accurately (within 10%) reflected angler use. Incomplete trip catch-per-unit-effort estimates obtained from a roving creel census were free from sampling bias. Stratification (weekends vs. weekdays) resulted in a twofold increase in precision of use estimates. A two-stage sampling design (time periods within days) improved efficiency of sampling. Motivations and values of interior Alaskan anglers were evaluated using survey questionnaires. Aspects of the fishing experience not related to catching fish, such as companionship, outdoor enjoyment, and relaxation, were primary motivations for most (94%) anglers. The catch-related motivations were also important to a large portion (63%) of anglers. The upper Chena River fishery had many attributes which, when taken together, provided satisfactory fishing experiences to a wide range of angler types.

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MARKING AND TAGGING

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86-001160 Cunningham, C. R.; J. F. Craig and W. C. Mackay. SOME EXPERIENCES WITH AN AUTOMATIC GRID ANTENNA RADIO SYSTEM FOR TRACKING FRESHWATER FISH. *Proc. Int. Conf. Wildl. Telemetry* 4:135-149. 1983. FR 31(1)
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STUDYING THE ACTIVITY OF PIKE, *ESOX LUCIUS* L. and PERCH, *PERCA FLUVIATILIS* L.
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86-001165 Nagiec, M. and C. Nagiec. MARKING OF JUVENILE WHITEFISH (*COREGONUS*
LAVARETUS L.) BY TETRACYCLINE ANTIBIOTICS. *Rocz. Nauk Roln. Ser. H Rybactwo*
100(3):107-114. 1983. In English with Polish and Russian summ. FR 31(1)
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86-001166 Tsukamoto, K. [MASS-MARKING OF AYU EGGS AND LARVAE BY TETRACYCLINE-
TAGGING OF OTOLITHS.] *Bull. Jpn. Soc. Sci. Fish.* 51(6):903-911. 1985. In
Japanese with English summ. FR 31(1)
[Ocean Res. Inst., Univ. Tokyo, Minamidai, Nakano, Tokyo 164, Japan] The
object of this study is to develop a method of mass-marking the egg and and
larval stages of fish in order to carry out field surveys of the early life
history and population dynamics of the fish. In this method the eggs or newl
hatched larvae are immersed in tetracycline hydrochloride (TC) solution and
marked-fish or fish from treated eggs are detected by the presence of
flourescent mark on otoliths under UV light. To determine the optimum TC
concentration and treatment time for marking the eggs and larvae of the ayu
Plecoglossus altivelis, a diadromous fish, various combinations of TC
concentration and treatment time (40-44 lots) were tested. As a result, 200-
300 mg/l for 24-48 h was found appropriate for eggs and 200-300 mg/ml for 3-24
for the larvae. Mark retention and the effect of TC treatment on survival and
growth were examined by rearing marked larvae in 500 l plastic tanks for more
than 5 months. The mark was easily descernible (100%) until 105 days after
hatching without any special preparation for detection. Even 164 days after
hatching the percentage of retention was 100% after grinding or etching in wea
acid, compared with 83% before such treatment. The treatment had no effect on
the survival and growth of the ayu. These results strongly suggest that thi
method can be applied to field surveys on the ayu during early life stage in the
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STOCKING AND INTRODUCTIONS

86-001168 Atkinson, J. R. and W. Maccallum. LAKE TROUT STOCKING. *Int. Assoc*
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STOCKING AND INTRODUCTIONS (CONTINUED)

86-001168 CONTINUED
[Ontario Minist. Nat. Resour., Ont. Gov. Bldg., 435 S. James St., Thunder Bay, ON P7C 5G6, Canada] The Ontario Ministry of Natural Resources plans to increase stocking of lake trout in Lake Superior from 1/2 million to 2 million per annum in the 1980's. A dynamic model is developed to predict the biological need for stocked lake trout for individual assessment areas in the Canadian waters of Lake Superior. The model is an annually updated matrix. One axis has past stocking, lake trout total mortality rate, number of eggs expected from stocked trout, survivors from these eggs and survivors from past stocking. The other axis has numbers and kilograms of vulnerable lake trout and numbers of sexually mature female lake trout. Stocking objectives are: 1. A lake trout biomass of 2.4 kg ha^{-1}, 2. A standing stock of 1000 mature female lake trout, 3. Stocking occurrence in 9 of 13 consecutive years if at all. Stocking is required if any of these objectives are calculated unfullfilled. Stocking requirements are then ranked with the areas of lowest lake trout mortality receiving highest priority for stocking. The model predicts that total mortality rates of less than 55% can sustain lake trout yield without stocking, however rates greater than 55% produce a risk of population collapse which increases as the rate increases. The total lake trout mortality increased from 54% in 1980 to 58% in 1983.

86-001169 Barwick, D. H. STOCKING AND HOOKING MORTALITY OF PLANTED RAINBOW TROUT IN JOCASSEE RESERVOIR, SOUTH CAROLINA. *N. Am. J. Fish Manage.* 5(4):580-583. 1985. FR 31(1)
[Duke Power Co., Rt. 4, P.O. Box 531, Hunterville, NC 28078]

86-001170 Kraai, J. E.; W. C. Provine and J. A. Prentice. CASE HISTORIES OF THREE WALLEYE STOCKING TECHNIQUES WITH COST-TO-BENEFIT CONSIDERATIONS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 37:395-400. 1983. FR 31(1)
[Tex. Parks Wildl. Dep., P.O. Box 835, Canyon 79015]

86-001171 McKaye, K. R.; R. D. Makwinja; W. W. Menyani and O. K. Mhone. ON THE POSSIBLE INTRODUCTION OF NON-INDIGENOUS ZOOPLANKTON-FEEDING FISHES INTO LAKE MALAWI, AFRICA. *Biol. Conserv.* 33(4):289-307. 1985. FR 31(1)
[Cape Maclear Fish. Stn., P.O Box 27, Monkey Bay, Malawi, Africa] It has been proposed that two zooplanktivorous sardines from Lake Tanganyika, *Stolothrissa tanganicae* and *Limnothrissa miodon*, be considered for possible introduction into Lake Malawi. Our data indicate that these clupeids, if introduced, would compete directly with the indigenous cichlid fishes, including the commercially important ones, all of which feed preferentially upon zooplankton. We conclude that such an introduction has a high probability of bringing about a collapse of the cichlid fisheries in Lake Malawi without the compensating increase in sardine catch. Such a prediction, of course, cannot be tested without the experiment being conducted. The data suggest that the risk to reward ratio is too large to consider such a drastic biological manipulation of Lake Malawi.

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[Me. Coop. Fish. Res. Unit, Dep. Zool., Univ. Me., Orono 04469]

86-001173 Pepper, V. A.; N. P. Oliver and R. Blundon. EVALUATION OF AN EXPERIMENT IN LACUSTRINE REARING OF JUVENILE ANADROMOUS ATLANTIC SALMON. *N. Am. J. Fish Manage.* 5(4):507-525. 1985. FR 31(1)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

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[Fla. Game Fresh Water Fish Comm., Rt. 1, P.O. Box 79F, Holt 32564]

FISHING GEAR AND TECHNIQUES

86-001178 Bain, M. B.; J. T. Finn and H. E. Booke. A QUANTITATIVE METHOD FOR SAMPLING RIVERINE MICROHABITATS BY ELECTROFISHING. *N. Am. J. Fish. Manage.* 5(3B):489-493. 1985. FR 31(1)
[Aquatic Biol. Prog., Dep. Biol., Ball State Univ., Muncie, IN 47306]

86-001179 Clark, R. A. EVALUATION OF SAMPLING GEARS FOR FISH POPULATION ASSESSMENT IN ALASKAN LAKES. *M.S. thesis, Univ. Alaska* 180p. 1985. FR 31(1)

Three lakes in Alaska's Interior and Kenai Peninsula were sampled during summers, 1982 and 1983, to evaluate sampling gears used for fish population assessment in Alaskan lakes. Two active gears (electrofishing boat and seines) and two passive gears (fyke nets and minnow trap) were evaluated for performance in catching power, size selectivity, species detection, fish destruction, manpower requirement, cost, portability, and field repairability. Three different electrofishing boat currents (AC, DC, and pulsed-DC) were also evaluated. The electrofishing boat had highest catching power, while fyke nets and minnow trap had highest catch per man-hour of labor. Seines had variable catching power, dependent upon shoreline substrate and sites to haul the seine to shore. Night electrofishing had higher catching power than day electrofishing when fished in a clear water lake, as opposed to equal catching power in a brown water lake. All three electrofishing currents exhibited a consistent pattern of length selectivity for coho salmon (*Oncorhynchus kisutch*). Planning of fish population assessment projects involves (1) clearly stated objectives, (2) knowledge of project constraints, physical or economic, and (3) knowledge of the sampling attributes of gears to be used.

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[CMFR, Calicut-5, India]

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During summers, 1982 and 1983, a variety of habitats were sampled on the Tanana and Kenai River drainages to evaluate sampling gears used for fish population assessment in Alaskan streams and rivers. Experiments were conducted to investigate sampling efficiency, length and species selectivity, and injuries to fish by three active (backpack electroshocker, electrofishing boat, seine), and two passive (minnow trap, fyke net) gear types. Gears were compared using a common set of attributes: accuracy, portability, scope or species detection, labor required, fishing power, fish savings (low mortality), and initial cost. Electrofishing systems were best for species detection and fishing power, while passive gears had higher catch per hour of labor. Large fyke nets and seines were effective under limited environmental conditions. A linear model was developed to assist in selecting an optimum fishing gear, or array of gears, for any level of fisheries population assessment, considering all applicable sampling constraints.

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FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

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[Wis. Dep. Nat. Resour., Bur. Res., Waupaca] The sport fishery for brown trout at Timber Coulee Creek during 1984 was characterized by very heavy angler use, primarily by local residents, a very impressive harvest by number and weight, and excellent angling quality in terms of average size and catch rates. However, if the high rate of exploitation by anglers in 1984 is typical, it is a serious biological problem deserving prompt management attention to prevent recurrence. More restrictive angling regulations should be implemented soon to preserve or enhance the excellent trout fishery this productive stream has the potential to provide.

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was used to protect 40 hectares of riparian stream habitat along 2.5 km of
Sheep Creek, Colorado, from adverse impacts due to heavy streamside recreation
use and cattle grazing. Fish habitat within the fenced area was narrower,
deeper, had less streambank alteration, and better streamside vegetation than
comparable unfenced sections. Estimated trout standing crop was twice as
great, and proportional stock density (PSD) was higher than in unfenced
sections. There was a higher proportion of nongame fish present in unfenced
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[Northern pike in lakes Logan and Rupert in southeast Ohio were stocked int
a temperature regime warmer than that which the species encounters in it
natural range. The objectives of this study were to evaluate survival an
bioenergetics of northern pike in their habitats. Field work was conducte
during fall 1979 through spring 1982; bioenergetc modeling during 1979 throug
1983. Organismal and population responses to this environment included rapi
growth, high juvenile mortality, decreased life span, behaviora
thermoregulation, and reduced activity. Two stockings in Lake Logan apparentl
failed, one in Lake Rupert declined to 3-6% of its stocked number within
month. Northern pike reached to mid-summer water temperatures by occupying th
coolest available water with sufficient dissolved oxygen. They remained
temperature near 25°C, which was the optimum temperature for growth on
libitum ration for this strain. However, bioenergetics modeling indicated hi
consumption rates were necessary for oversummer growth, and optim
temperature for growth were lower than 25°C if smaller rations were consume
Adults in Lake Logan grew most rapidly and accumulated most of their weight
spring and summer. Juveniles in Lake Rupert grew rapidly late in summer, b
most of their weight gain occurred overwinter. Adults in this lake lost weig
in early summer regained some weight in late summer and fall, and accumulat
most

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

86-001250 CONTINUED of their annual biomass increment during winter. Adult diet was almost entirely gizzard shad (*Dorosoma cepedianum*), even though centrachids were more abundant. Age 0 pike ate mostly bluegill (*Lepomis macrochirus*) until they could capture gizzard shad. Radiotelemetry revealed that northern pike selected microhabitats, such as logs, creek channels, and moderately dense macrophytes. Average rates of movement were low (<1cm/s), and did not vary significantly among months. Home ranges varied from 20 m^2 to 33 hectares, but temperature, fish size, or gender did not affect size of home range. Stocking fingerlings >250 mm total length during fall may enhance survival by minimizing predation risk and metabolic cost, but observations of the species elsewhere along the southern part of its range indicate that densities of 0.5 to 1.9 adults per hectare that I observed in these lakes may be near the maximum attainable.

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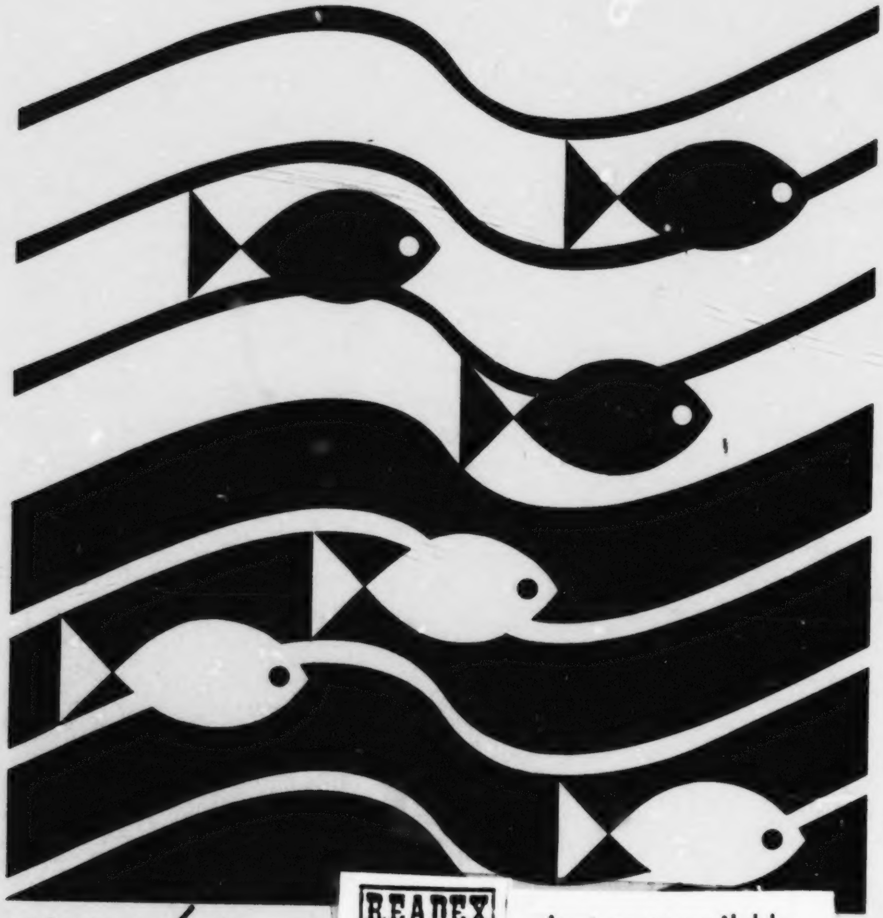

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[Ontario Minist. Nat. Resour., Res. Sect., Fish. Br., Box 50, Maple, ON L0J 1E0, Canada] Brook trout, *Salvelinus fontinalis*, in Dickson Lake, Ontario, spawn on two shoal areas of approximately 450 m^2 and 80 m^2, respectively. The larger spawning bed is a gravel-sand shoal that extends in the form of a semicircle up to 25 m from the shore in water less than 1 m deep. Spawning fish are apparently attracted to groundwater which seeps slowly up through the shoal at various locations. Females concentrate their redd-digging activities over the seepage areas and, although a few individual redds are distinguishable, the actual spawning bed is made up of contiguous redds which form several irregularly shaped "cleaned" areas on about 25% of the shoal area. Tag and recapture studies, in October 1967, placed the adult population at 1,300 fish averaging 41 cm in length. Spawners ranged from 2+ to 8+ years of age, but 80% were in the 3+ and 4+ classes. The sex ratio was even and egg production averaged 2,300 per female. Spawning occurred from mid-October to late November, with peak egg deposition occurring during the first ten days of November. Hatching occurred during February, and fry emerged from the gravel through March into April. Core samples removed from the spawning bed indicated substantial egg mortality (>30%) due to superimposition of redds. Also, there was evidence of mortality of embryos in late stages of development that was probably related to decreased levels of dissolved oxygen. The limited amount of suitable spawning facilities available to Dickson Lake brook trout has probably limited the size of the population.

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[Dep. Biol. Sci., Bowling Green State Univ., Bowling Green, OH 43403] Diets of white perch and white bass were compared to assess diet similarity and potential of competition between these two species. White perch, a recent colonizer of Lake Erie, has increased in abundance and may potentially effect native white bass population. Diets of both species were examined in Sheldons's Marsh and Old Woman Creek, two shallow, inshore areas in the central basin of Lake Erie. Fish were collected from April through October, 1983 using trap nets. Comparisons of diets were made using percent composition of prey taxa by number and biomass. Results of these analyses indicated that both species fed on fish, zooplankton, and benthos. Diets differed, however, in that fish prey comprised the major component of white bass diet whereas white perch fed more on zooplankton. Both species fed equally on benthos. These data suggest that white perch and white bass diets do overlap in these inshore areas and that these species may potentially interact.

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[Zool. Inst., Univ. Wien, Althanstr. 14, A-1090 Wien, Austria] Chars from seven Austrian lakes (three above the timber line, four in the Austrian lake district Salzkammergut) have been studied. The digestive tract filling

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86-001683 CONTINUED in percent of body weight is higher among the dwarfed forms in high-mountain lakes than among better growing populations in lower-laying areas. This is an argument against the theory that dwarfed chars suffer starvation. In Mittlerer Plenderlesee, surface food predominates during the ice-free period; under the ice cover chars feed mainly on aquatic insect larvae. In Oberer Plenderlesee the (summer) food is similar. In Drachensee in summer, more chironomid pupae than surface food are taken up, in winter mainly aquatic insect larvae. In the lakes studied in Salzkammergut, chars tend to feed in summer nearly entirely on crustacean-plankton and chironomid pupae; in winter they take more benthic food. In Hallstättersee, however, they seem to be forced out of the plankton zone by coregonids. Fish are only rarely found in the digestive tract.

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[Dep. Civil Eng., Univ. Iowa, Iowa City] A small fraction of lakes sampled in the Upper Midwest are presently acidic (0% in northern Minnesota, 4% in northcentral Wisconsin, and about 19% in the eastern part of the Upper Peninsula of Michigan). Field data and analysis suggest that these lakes have been acidified by acid deposition for the following reasons: a) Acid lakes are found only where there is significant acid precipitation (ph≤4.6) across the depositional gradient. b) Acid lakes are mainly (88%) seepage type lakes that receive most of their water from precipitation falling directly on the surface of the lake and have no permanent inlets or

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86-001868 CONTINUED outlets. c) Sulfate is the dominant anion in precipitation and in the chemistry of these lakes. d) Mass balance calculations at calibrated watersheds (Lake Clara and Lake Vandercook) indicate that more than 90% of hydrogen ions come directly from precipitation. The upper midwest is sensitive to future increases in acid deposition. At the precipitation pH found in the Adirondack Mountains of New York (ph 4.1), about 30% of the lakes would be acidified based on model predictions. The model described here is based on a mass balance for alkalinity in a lake. It was calibrated with field measurements, and the kinetic formulations were based on laboratory experiments reported in the literature on chemical weathering. The model can be used in a steady-state or a time-variable mode to yield the response to scenarios of increasing or decreasing acid deposition. It is a tool that may be used to estimate the lake resources at risk at various levels of acidic deposition.

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[Dep. Zool., Miami Univ., Oxford, OH 45056] Stoneroller minnows, *Campostoma anomalum*, were exposed to four sublethal concentrations of phenol (6, 8, 10, and 12 ppm) for 48 hours, and the effects of these concentrations on temperature tolerance (CTMax) and low dissolved oxygen tolerance were observed. The mean CTMax values of fish exposed to 6 and 8 ppm

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86-001882 CONTINUED phenol (35.6 and 35.3 C, respectively) did not differ from the mean CTMax recorded for control fish (35.8 C). Although fish exposed to 8 ppm phenol exhibited loss of equilibrium at a lower mean dissolved oxygen concentration (1.5 mg $0_2 \cdot 1^{-1}$) than the control group (1.9 mg $0_2 \cdot 1^{-1}$), these values were not significantly different. Fish exposed to 6 ppm phenol had a significantly greater ($P<0.05$) mean oxygen tolerance (1.3 mg $0_2 \cdot 1^{-1}$) than the control group. Exposure to 10 ppm phenol significantly depressed temperature tolerance (34.7C but did not affect low oxygen tolerance (1.9 mg $0_2 \cdot 1^{01}$). The results of the present study suggest that stoneroller minnows may become more sensitive to increased temperature and decreased dissolved oxygen concentrations following exposure to sublethal concentrations.

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[Lilly Res. Lab., Greenfield, IN 46140] The acute and chronic toxicities of the herbicide fluridone to aquatic invertebrates and fish were evaluated. The acute median lethal concentrations (LC50s) of fluridone were 4.3±3.7 mg/L (x±SD) for invertebrates (n=15) and 10.4 ±3.9 mg/L for fish (n=28). In chronic studies, no effects were detected when daphnids (*Daphnia magna*) were continuously exposed to fluridone concentrations of 0.2 mg/L or less for 32 d, amphipods (*Gammarus pseudolimnaeus*) to 0.6 mg/L or less for 60 d or midge larvae (*Chironomus plumosus*) to 0.6 mg/L or less for 30 d. Fathead minnows (*Pimephales promelas*) were not affected by continuous exposure to fluridone concentrations of 0.48 mg/L or less over their life cycle. The growth and survival of channel catfish (*Ictalurus punctatus*) were not adversely affected by continuous exposure to floridone concentrations of 0.5 mg/L or less for 60 d after hatching. The channel catfish accumulated fluridone concentrations two to nine times greater than that in water. The recommended application rate of 1 lb/acre of fluridone to a pond with an average depth of 3 ft provides a theoretical concentraion of 0.1 mg/L. Thus, an initial fluridone concentration of 0.1 mg/L or less is recommended to control weeds in ponds. Consequently, fluridone is not expected to have adverse effects on the species tested or on similar nontarget aquatic organisms.

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86-001913 Nimi, A. J. and B. G. Oliver. BIOLOGICAL HALF-LIVES OF CHLORINATED DIBENZO-p-DIOXINS AND DIBENZOFURANS IN RAINBOW TROUT (*SALMO GAIRDNERI*). *Environ. Toxicol. Chem*. 5(1):49-53. 1986. FR 31(2)
[Great Lakes Fish. Res. Br., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada] The biological half-lives of five dibenzo-p-dioxins and two dibenzofurans were determined in rainbow trout following a single oral exposure. Estimated half-lives ranged from 2 d for 2, 7-dichlorodibenzo-p-dioxin to 43 d for 1, 2, 3, 4-tetrachlorodibenzo-p-dioxin among the dioxins, and from 12 d for octachlorodibenzofuran to 24 d for 3, 6-dichlorodibenzofuran. No consistent relationship was shown between half-life and the degree of chlorination. Absorption efficiencies varied from 2 to greater than 30%, although most values ranged from 5 to 16%.

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In 1979 and 1980 the Fisheries Research Section conducted a 2-year study on Little Emerald Lake and Emerald Lake, collectively called Emerald Lakes. Emerald Lake, the third largest natural lake in Colorado, supports a self-sustaining hybrid rainbow-cutthroat trout population originating from the introduction of these two species in the late 1880's. Inlet and outlet spawning habitats, which sustain this trout population, were delineated. In 1980 the inlet stream contained 581 m^2 of reproductive habitat; the outlet stream contained 805 m^2 of spawning habitat and 695 m^2 of reproductive habitat. In 1980 there were 2,985 (±372) adults in the outlet spawning run and 2,357 (±239) adults in the inlet spawning run. Age and growth calculations were based on 962 scales collected from trout at the inlet and outlet weir sites and by gillnetting Emerald Lakes. Age groups III, IV, and V made up 93% of the outlet and 83% of the inlet spawning runs. The difference in summer water temperatures between inlet and outlet spawning counts, to distinguish between inlet- and outlet-origin spawning sites. As a result it was estimated that 62% of the adults sampled in the Emerald Lakes system had circuli counts that identified them as originating from outlet spawning sites. Creel survey data indicated an

LAKE MANAGEMENT AND RESEARCH (CONTINUED)

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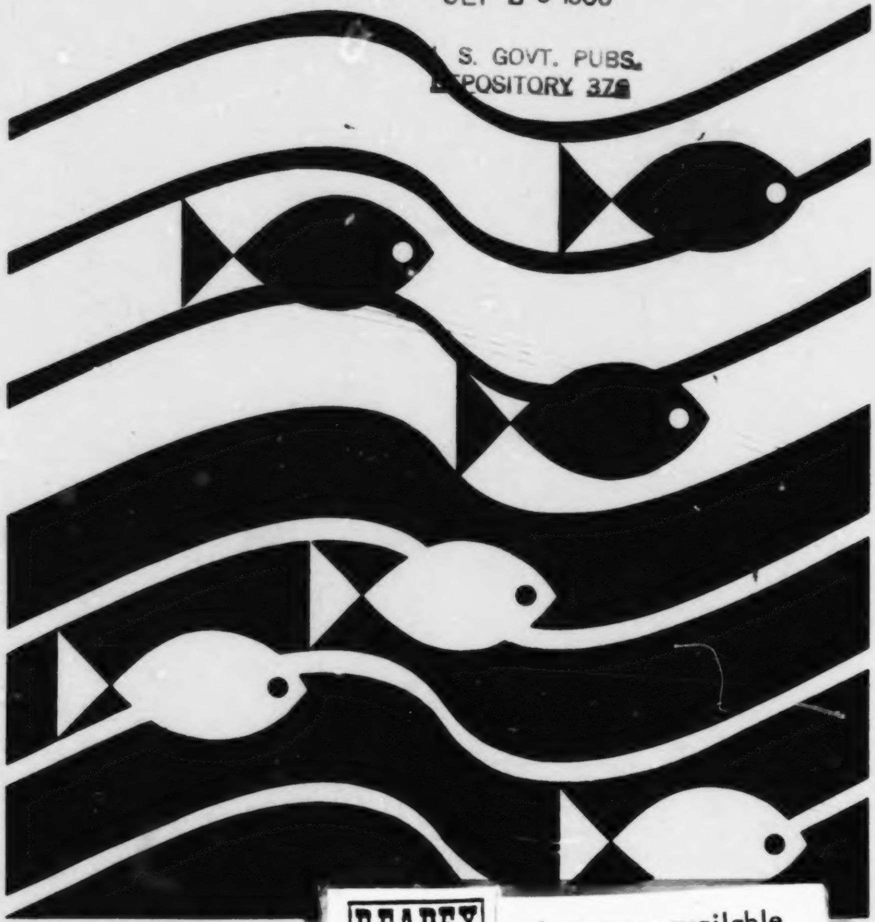

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[U.S. FWS, Natl. Fish Hatchery and Technol. Cent., San Marcos, TX 78666]
A study was conducted to determine if the threatened Guadlupe bass *Micropterus treculi* could be adapted to hatchery production. Five hormone injected fish (one female, four males) stocked in a 0.04 hectare spawning pond produced approximately 1,200 harvestable fingerlings. The fish were size-graded into 3 classes and stocked into indoor rectangular tanks. Fingerlings (22-45mm total length; 0.3-1.0 g) were trained to consume semimoist pellets (1.0-1.5 mm in diameter) in a simulated production environment at a rate greater than 48% of the stocked biomass/day throughout the 24-day training period. Training success for the three size classes was 96, 98, and 100%. Growth rates were similar to those of other *Micropterus* species. These results indicate that the Guadalupe bass is adaptable to fish hatchery conditions and, therefore, can be produced to supplement depleted native populations.

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[Dep. Zoophysiol., Uppsala Univ., Box 560, S-751 22 Uppsala, Sweden] The behaviour of juvenile Artic charr, *Salvelinus alpinus* (L.). to an abrupt concentration step of L-amino acids, L-alanine and ammonium chloride was studied by fluviarium technique. The emission rates of these substances were studied. Juvenile Arctic charr emit 8.0 x 10^{-4} mol total ammonia-N $kg^{-1}h^{-1}$ and 3.3 x 10^{-5} mol amino acids $kg^{-1}h^{1}$. In behaviour tests the charr avoided 5.6 x 10^{-6} and 5.6 x 10^{-7} M, ammononium chloride. The 17 L-amino acid mixture, ranked as observed in the analyis of emission, was avoided at 4.6 x 10^{-7}M, while 100 times dilution of this value gave neither avoidance nor attraction. The charr avoided L-alanine tested alone at the concentration of 4.6 x 10^{-7} M. Anosmic charr showed neither avoidance nor attraction to the mixture of 17 amino acids tested at 4.6 x 10^{-7} M. The results indicate that ammonia as well as emitted amino acids are not responsible for the olfactory mediated attraction to conspecific odour shown earlier in Arctic charr. On the contrary, these substances may have a negative effect by reducing the strength of attraction.

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[Dep. Anim. Physiol., Catholic Univ., Toernooiveld, 6525 ED Nijmegen, Netherlands] In The Netherlands, the mudminnow *Umbra pygmaea* mainly occurs in water bodies with a pH ranging from 3.5 to 4.0, an alkalinity less than 0.1 meg 1^{-1} and a calcium content below 100 umol 1^{-1}. The abundance of mudminnows is inversely related to the pH and the presence of predatory fish species. Experimental studies show that *U. pygmaea* is extremely acid-tolerant. Exposure to media with pH values ranging from 4.0 to 7.0 did not cause mortality or significant changes in blood plasma osmotarity and haematocrit. At pH 3.0 no mortality was recorded although a strong decrease in the plasma osmolarity was observed. Exposure to pH 2.8 and calcium concentrations of 100 or 500 umol 1^{-1} for 10 days caused 70% and and 40% mortality respectively. The growth, reproduction and feeding of mudminnows are described. Age-growth and length-age relationships were calculated. Gonadal development started between September and January. The highest Gonado Somatic Index was recorded in spring. Spawning occurred from April to May. Fecundity of a sample of females was assessed. Nematocera provided the main item of diet of *U. pygmaea*; the microfaun ingested was dominated by Cladocera. The adaptations of mudminnows to acid environments are discussed.

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[La. Dep. Wildl. Fish., P.O. Box 88, Bourg 70343] *Cyprinodon variegatus hubbsi*, which recently was reduced to subspecies status by Johnson (1974), is endemic to eight lakes (Carlton, Beauclair, Dora, Harris, Eustis, Yale, Griffin and Weir) in the upper Oklawaha River, St. Johns River drainage of central Florida. Biological and geological evidence indicate *C. v. hubbsi* evolved from a population of Gulf *C. v. variegatus* that became isolated in marine lagoons at the present site of the Oklawaha River headwaters. The characteristic habitat of the species is narrow, wave-washed, shallow strips of clean sandy beaches. *Cyprinodon v. hubbsi* comprised 4% of the total number of fishes and appeared in 54% of seine collections. Considering abundance data, the vulnerability of the habitat to degradation, and its limited range, the conservation status of *C. v. hubbsi* is reduced from "threatened" to "species of special concern" by the Florida Game and Fresh Water Fish Commission.

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[Mar. Sci. Lab., Menai Bridge, Anglesey, North Wales LL59 5EH, Wales] As part of an investigation on the effect of natural oil seeps and oil-bearing substrata on littoral organisms, a study was made on the effect of the presence of freshly exposed Blackstone oil shale from Kimmeridge on the Dorset coast on the behaviour of the common littoral fish the blenny *Blennius pholis* L. in a simulated rock pool habitat. Plastic test chambers were designed with two compartments, one contained sea water and the other contaminated sea water which had been allowed to equilibrate with pieces of Blackstone oil shale and in some experiments further modified by decreasing the pH to simulate natural CO_2 build up in rock pools. The fish were allowed to enter the sea water in either compartment from one of three types of ramp positioned above the surface. The results showed that against appropriate controls, fish which were able to sample a saturated atmosphere avoid coming into contact with equilibrated shale oil-contaminated sea water. As the shale oil content decreased the aversion decreased but the oil still affected the ability of the fish to detect a decrease in pH. Apparently the presence of shale oil leachings in the sea water interferes with the ability of the blenny to discriminate certain characteristics of the physico-chemical environment which would otherwise by avoided.

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TOXICOLOGY; BIOASSAYS (CONTINUED)

86-003122 CONTINUED concentrations of Mn, Fe, Cu, Pb, and Zn were obtained in the gills of the treated fish. Ultrastructural changes including separation of the epithelium from the pillar cell system and subsequently increasing the blood-water barrier, necrosis of lamellar cells, collapse of lamellar blood spaces, and hyperplasia of interlamellar cells were found in the lamellae of the gills of the treated fish.

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[Water Res. Cent., Medmenham Lab., Henley Rd., Medmenham, P.O. Box 16, Marlow, Bucks. SL7 2HD, England] As part of a programme of acquiring data for preparing standards to safeguard European, non-salmonid, freshwater fish from pollution, toxicity tests were carried out in hard, well-aerated water. Asymptotic median lethal concentrations (LC50s) of undissociated ammonia, cyanide, nitrate and phenol to one or more of three species were determined. The LC50s were as follows: to common carp 16mgl^{-1} as NO_2-N; to perch 0.1 mgl^{-1} as HCN; to roach 0.35 mgl^{-1} as NH^3-N, 0.11 mgl^{-1} as HCN, 10'1 mgl^{-1} as NO_2-N and 10mg l^{-1} as phenol. In order to define these LC50s, exposure periods within the range 0'3 days (phenol) to 14 days (nitrite) were required. Comparisons are made with other data and the tentative water quality 'criteria' proposed by the European Inland Fisheries Advisory Commission.

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HABITAT ALTERATIONS (CONTINUED)

86-003183 CONTINUED and gas well shell pads, and offshore petroleum platforms were in place in 1984. There were ~ 20,000 ha of open water spoil disposal sites permitted in coastal waters and 1362 bay piers and docks on record. Fourteen jetties were in place or under construction with a bottom area of 228 ha. Oil companies have placed a minimum of 395 oyster shell pads in the bays, each approximately 0.1 ha. There were 181 offshore petroleum platforms and sub-sea installations located in state territorial waters.

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MARKING AND TAGGING

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STOCKING AND INTRODUCTIONS

86-003234 Buynak, G. L. SMALLMOUTH BASS STOCKING EVALUATION AT HERRINGTON LAKE. *Ky. Dep. Fish Wildl. Resour. Fish. Bull.* No. 79. 14p. 1986. FR 31(3)
A total of 561,334 smallmouth bass ranging in length from fry to 3.5 inches were stocked into Herrington Lake from 1978-1981 in an attempt at re-establishing smallmouth bass in the lake. For the first 30 years of impoundment, a self-sustaining smallmouth bass fishery existed in the lake. Cove-rotenone data collected from 1948 through 1955 indicated that a viable smallmouth bass population existed during these years. After 1955, only one fingerling-sized (5 inches) smallmouth bass was taken in 1961 and one harvestable-size (≥10 inch) smallmouth bass was collected in 1976. A selective shad removal program conducted from 1956-1959 was at one time thought to be responsible in part for the elimination of smallmouth bass from Herrington Lake. Results of this evaluation study of the smallmouth bass stocking showed that a self-sustaining fishery did not result from the stocking of large numbers of smallmouth bass into the lake. During the 4 years of stocking, smallmouth bass made up a mean of only 0.9% of the total number and 0.7% of the total weight of bass collected during cove-rotenone

STOCKING AND INTRODUCTIONS (CONTINUED)

86-003234 CONTINUED studies. No smallmouth bass of any size were collected in rotenone studies from 1982-1985. Creel survey data collected from 1980 through 1984 indicated that some of the stocked smallmouth bass did survive, Grow, and contribute to the creel. Stocked smallmouth bass accounted for a mean of 1.3% of the total number and 1.1% of the total weight of bass harvested in these Years. For a smallmouth bass stocking program to be considered a success at developing a self-sustaining fishery, this species is expected to contribute about 10% to the black bass biomass and/or 10% of the yield of all bass. Little, if any, reproduction success from 1982 year class was evident from the 1985 creel survey results to indicate that the stocked fish have developed a viable self-sustaining population. The apparent reason for both the elimination of smallmouth bass from the lake in the 1950's and the failure at re-establishing the smallmouth bass fishery is a result of eutrification and the gradual reduction and subsequent elimination of coolwater habitat suitable for smallmouth bass in the lake.

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86-003242 Kohler, C. C. STRATEGIES FOR REDUCING RISKS FROM INTRODUCTIONS OF AQUATIC ORGANISMS. *Fisheries (Bull. Am. Fish. Soc.)* 11(2):2-3. 1986. FR 31(3)
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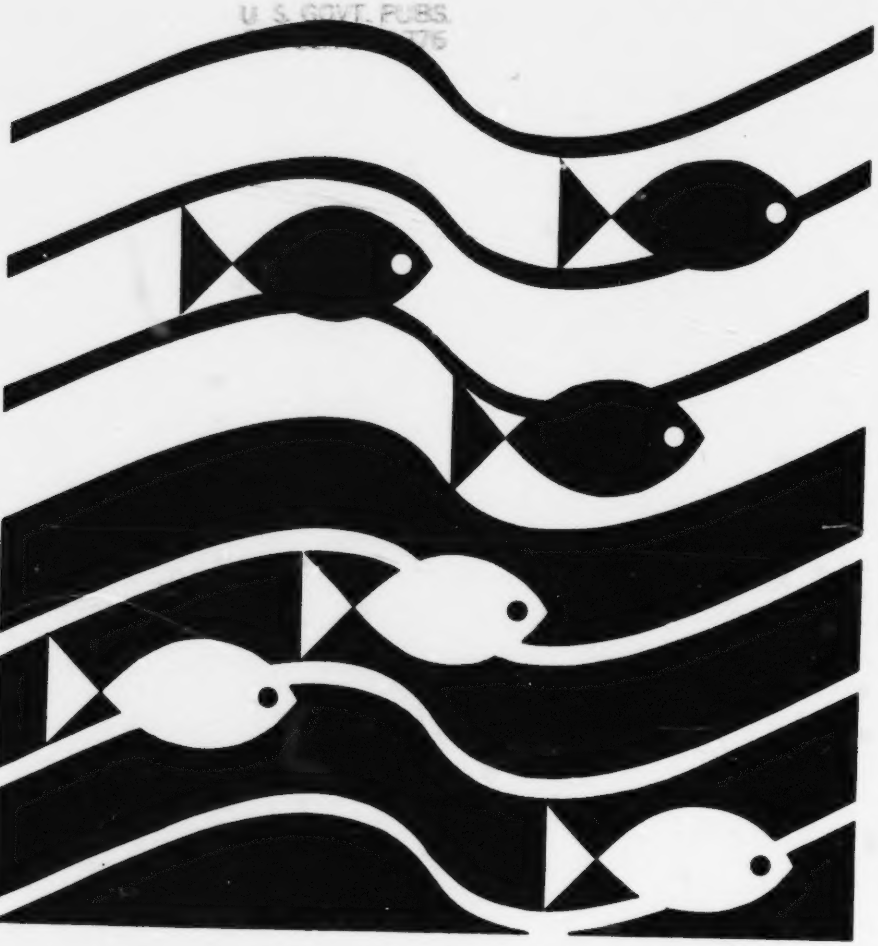

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[NMFS, Auke Bay, AK] Seasonal changes in distribution and habitat selection by juvenile salmonid fishes were studied in Porcupine Creek, a small coastal stream in an old-growth forest in southeast Alaska. During summer, coho salmon (*Oncorhunchus kisutch*) were distributed in both stream/estuary ecotone and freshwater reaches, and biomass (g per m^2) was directly related to total pool volume. Trout (*Salmo gairdneri* and *S. clarki*) and Dolly Varden char (*Salvelinus malma*) were not common in the stream/ estuary ecotone but were common in freshwater. Total salmonid biomass during summer was directly related to the amount of large organic debris in the stream. Tagged salmonids showed little movement during summer but redistributed themselves within the Porcupine Creek system before winter. Coho moved out of the stream/estuary ecotone to upstream freshwater areas to overwinter. In late autumn, coho used primarily large mainstream pools, backwater pools, and secondary-channel pools, and trout and char used primarily debris or undercut banks on the edges of riffles. Resource managers need to take into account seasonal changes in habitat requirements when assessing effects of logging or other land uses on fish habitat in streams.

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[Va. Inst. Mar. Sci., Sch. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062] The chemotactic efficiency of macrophages isolated from the kidney of spot, *Leiostomus xanthurus*, and hogchoker, *Trinectes maculatus*, was determined in fish captured from the York River and the heavily polluted Elizabeth River (Virginia). Chemotactic activity was quantified in Boyden chambers using *Escherichia coli* as the chemotactic stimulus. Macrophage chemotaxis was found to be markedly reduced in the Elizabeth River fish as compared to York River controls. Chemotactic migrations of macrophages at 90 min were 55% and 33% for control and experimental spot, respectively. Values for control and experimental hogchoker were 85% and 56%, respectively. The macrophage chemotactic activity of Elizabeth River fish returned to normal (spot, 56%; hogchoker, 80%) after the fish were held in clean water for 3 weeks. This indicates that the cecreased chemotactic activity was related to exposure to Elizabeth River pollutants but may be reversible.

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86-005375 Bacalbasa-Dobrovici, N. THE EFFECTS ON FISHERIES OF NON-BIOTIC MODIFICATIONS OF THE ENVIRONMENT IN THE EAST-DANUBE RIVER AREA. *In: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 13-27. In English with French summ. FR 31(4)

HABITAT ALTERATIONS (CONTINUED)

86-005376 Backiel, T. FALL OF MIGRATORY FISH POPULATIONS AND CHANGES IN COMMERCIAL FISHERIES IN IMPOUNDED RIVERS IN POLAND. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 28-46. In English with French summ. FR 31(4)

86-005377 Behnke, R. J. EMPIRICAL EVIDENCE AND INFERENCE AS A PROVISIONAL BASIS FOR PREDICTION AND MANAGEMENT OF UPPER COLORADO RIVER BASIN FISHES. *Proc. Desert Fishes Counc.* 13-15:351. 1985. Abstract only. FR 31(4)

86-005378 Bisson, P.A. and J. R. Sedell. SALMONID POPULATIONS IN STREAMS IN CLEARCUT VS. OLD-GROWTH FORESTS OF WESTERN WASHINGTON. *IN W. R. Meehan; T. R. Merrell, Jr. and T. A. Hanley (eds.) Fish and Wildlife Relationships in Old-Growth Forest. (Am. Inst. Fish. Res. Biol.)* p. 121-130. 1984. Available @ $20.00 from J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)

[Weyerhaeuser Co. Technol. Cent., Tacoma, WA 98477] Cutthroat trout (*Salmo clarki*), juvenile steelhead trout (*S. gairdneri*), and juvenile coho salmon (*Oncorhynchus kisutch*) were sampled during the low-flow period of summer to compare population biomasses in western Washington streams flowing through old-growth forests with those in areas recently clearcut. In paired logged and unlogged sites, total salmonid biomasses averaged 1.5 times greater after logging than in adjacent unlogged sections. Among all sites (paired plus unpaired locations), total salmonid biomasses were 2.0 times greater, on average, in clearcuttings. Streams in logged watersheds contained higher percentages of age-0+ steelhead and age-0+ cutthroat trout, and lower percentages of age-0+ coho salmon and age-1+ and -2+ cutthroat, compared to streams in old-growth forests. Shifts in species and age composition were related to habitat changes that resulted from timber harvesting and debris removal from the channels. Large, stable organic debris declined and unstable debris increased after passage of forest practices legislation that mandated immediate debris removal following logging. Pool volumes decreased and riffle volumes increased after streambank disturbances and channel clearance, although the frequency (number per km) of both pools and riffles was lower in streams flowing through clearcut sites. Riffles in streams that underwent extensive debris removal were elongated and in many cases extended through former pool locations. Increases in the proportional abundance of underyearling steelhead and cutthroat trout after clearcutting is possibly explained by the preference of these fishes for riffle habitat, while the relative decline of coho and older cutthroat may have resulted from the loss of pool volume and large, stable debris for cover.

86-005379 Bjornn, T. C. THE TIMBER HARVEST-FISH PRODUCTION PROBLEM: ARE WE MAKING ANY PROGRESS? *IN W. R. Meehan, T. R. Merrell, Jr., and T. A. Hanley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. Res. Biol.)* p. 5-7. 1984. Available @ $20.00 from J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow]

86-005380 Boytsov, M. P.; V. P. Gurov and Y. R. Nikanorov. COMPOSITION, ABUNDANCE AND GROWTH OF JUVENILE FISH IN A DREDGED AREA OF IVAN'KOVO RESERVOIR. *Hydrobiol. J. (Engl. Transl. Gidrobiol. Zh.)* 22(2):27-31. 1986. FR 31(4)
[GosNIORKh, Konakova, USSR]

86-005381 Bustard, D. R. QUEEN CHARLOTTE ISLANDS STREAM REHABILITATION STUDIES: A REVIEW OF POTENTIAL TECHNIQUES. *British Columbia Minist. For. Land Manage. Rep.* No. 28. vi+31p. 1984. FR 31(4)
[P.O. Box 2792, Smithers, BC V0J 2N0, Canada]

HABITAT ALTERATIONS (CONTINUED)

86-005382 Collins, K. D. and O. E. Maughan. SOME RELATIONS BETWEEN CLEARCUTTING AND WARM-WATER FISH POPULATIONS. *In: R. F. Wittwer (ed.). Proceedings of a Conference: Creating Good Wildlife Habitat Through Forest Management and Conservation.* p. 69-79. 1983. FR 31(4)
[Okla. Coop. Fish. Res. Unit, Okla. State Univ., Stillwater 74078]

86-005383 Crisp, D. T. EFFECTS OF IMPOUNDMENT AND REGULATION OF THE RIVER TEES AT COW GREEN (NORTHERN PENNINES, UK) UPON FISH POPULATIONS IN AFFERENT TRIBUTARIES AND IN THE RIVER IMMEDIATELY DOWNSTREAM OF THE DAM. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN*. 1985. p. 42-51. In English with French summ. FR 31(4)

86-005384 Dadswell, M. J.; R. A. Rulifson and G. R. Daborn. POTENTIAL IMPACT OF LARGE-SCALE TIDAL POWER DEVELOPMENTS IN THE UPPER BAY OF FUNDY ON FISHERIES RESOURCES OF THE NORTHWEST ATLANTIC. *Fisheries (Bull. Am. Fish. Soc.)* 11(4):26-35. 1986. FR 31(4)
[Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

86-005385 Davis, J. W. LIVESTOCK AND RIPARIAN HABITAT MANAGEMENT--WHY NOT? *Proc. Desert Fishes Counc.* 13-15:227-234. 1985. FR 31(4)

86-005386 Egglishaw, H. J. AFFORESTATION AND FISHERIES. *IN: J S. Alabaster, (ed.). Habitat MOdification and Freshwater Fisheries. FAO of the UN.* 1985. p. 236-244. In English with French summ. FR 31(4)

86-005387 Elliott, S. T. REDUCTION OF A DOLLY VARDEN POPULATION AND MACROBENTHOS AFTER REMOVAL OF LOGGING DEBRIS. *Trans. Am. Fish. Soc.* 115(3):392-400. 1986. FR 31(4)
[Alaska Dep. Fish Game, Div. Sport Fish., P.O. Box 20, Douglas, AK 99801]

86-005388 Ford, R. SUCKERS TO TROUT--EFFECT OF HABITAT RESTORATION ON FISH POPULATIONS IN RAPID CITY, SOUTH DAKOTA. *In: Richardson, F. and R. H. Hamre (Tech. eds.). Wild Trout III*. p. 133-136. 1985. FR 31(4)
[S.D. Dep. Game Fish Parks, Rapid City] A flood prevention project completed in 1978 severely altered an 825 yds. portion of Rapid Creek to a shallow channel, 32 yds. wide, in Rapid City, South Dakota. Subsequent agreement with the U.S. Army Corps of Engineers resulted in a stream rehabilitation project which used wing deflectors and rip-rap to restore the channel to a meandering 9 yds. wide channel. Fish population response was monitored annually using electrofishing gear. Brown trout *(Salmo trutta)* numbers increased 461%, while numbers of mountain suckers *(Catastomus platyrhynchus)* and white suckers *(C. commersoni)* decreased 86% and 55% respectively from 1978 to 1983.

86-005389 Gordon, W. G. NMFS AND ARMY CORPS OF ENGINEERES RESTORE FISHERIES HABITATS: A COOPERATIVE VENTURE. *Fisheries (Bull. Am. Fish. Soc.)* 11(5):2-7. 1986. FR 31(4)
[NMFS, 1825 Connecticut Ave., N.W., Washington, DC 20235]

86-005390 Hartman, G. F.; L. B. Holtby and J. C. Scrivener. SOME EFFECTS OF NATURAL AND LOGGING-RELATED WINTER STREAM TEMPERATURE CHANGES ON THE EARLY LIFE HISTORY OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) IN CARNATION CREEK, BRITISH COLUMBIA. *IN W. R. Meehan; T. R. Merrell, Jr. and T. A. Handley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. Res. Biol.)* p. 141-149. 1984. Available @ $20.00 from J. W.

HABITAT ALTERATIONS (CONTINUED)

86-005390 CONTINUED Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada] Carnation Creek is a small rain-forest stream located on Barkly Sound, Vancouver Island, British Columbia. It is the site of a 15-year watershed study concerned with the impact of logging on anadromous and resident salmonids. This paper deals with some of the effects of natural and logging-induced stream temperature changes in winter on juvenile coho salmon. Extensive logging began in the winter of 1976-77 and continued until 1980-81, by which time 41% of the watershed had been clearcut. Stream temperatures in early winter from 1976-77 through 1980-81 were higher than they had been prior to logging. Temperature increases resulted from climatic amelioration, which began in 1976, and from the effects of logging. As a result of higher temperatures, coho salmon fry emerged earlier in the spring than they had prior to logging. Early emergent fish that did not move downstream during spring freshets began growing sooner. In 1981, the year of highest winter temperatures, fry emerged 47 days earlier than in the prelogging years and this, coupled with faster growth in late spring, led to the fish entering their first winter at a larger size. Consequently, survival through the winter was greater, leading to increased numbers and size of 1-year smolts and an increased proportion of 1-year versus 2-year smolts. Brief speculation is offered about processes that have affected stream temperatures during winter.

86-005391 Hawkins, P. R. and D. J. Griffiths. LIGHT ATTENUATION IN A SMALL TROPICAL RESERVOIR (SOLOMON DAM, NORTH QUEENSLAND): SEASONAL CHANGES AND THE EFFECTS OF ARTIFICIAL AERATION. *Aust. J. Mar. Freshwater Res.* 37(2):199-208. 1986. FR 31(4)
[Botany Dep., James Cook Univ. North Queensland, Townsville, Qld. 4811, Australia]

86-005392 Holland, L. E. EFFECTS OF BARGE TRAFFIC ON DISTRIBUTION AND SURVIVAL OF ICHTHYOPLANKTON AND SMALL FISHES IN THE UPPER MISSISSIPPI RIVER. *Trans. Am. Fish. Soc.* 115(1):162-165. 1986. FR 31(4)
[U.S. FWS, P.O. Box 818, La Crosse, WI 54602]

86-005393 Jutila, E. DREDGING OF RAPIDS FOR TIMBER-FLOATING IN FINLAND AND ITS EFFECT ON RIVER-SPAWNING FISH STOCKS. *IN: J. S. Alabaster, (ed.). Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 104-108. In English with French summ. FR 31(4)

86-005394 Klassen, H. D. GABION EVALUATION FOR SALMONID ENHANCEMANT IN A LANDSLIDE IMPACTED STREAM ON THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA. *British Columbia Minist. For. Land Manage. Rep.* No. 30. xi+94p. 1984. FR 31(4)
[Fish For. Interaction Proj., 2153 W. 46th Ave., Vancouver, BC V6M 2L2, Canada]

86-005395 Leonardson, L. ENERGY EXTRACTION FROM LAKE SEDIMENTS WITH HEAT EXCHANGERS. EFFECTS ON WATER QUALITY, SEDIMENT, BOTTOM FAUNA, AND FISH. *Int. Ver. Theor. Angew. Limnol. Verh.* 22(4):2249-2253. 1985. FR 31(4)

86-005396 Lestelle, L. C. and C. J. Cederholm. SHORT-TERM EFFECTS OF ORGANIC DEBRIS REMOVAL ON RESIDENT CUTTHROAT TROUT. *IN W. R. Meehan; T. R. Merrell, Jr. and T. A. Hanley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. REs. Biol.)* p. 131-140. 1984. Available @ $20.00 from J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Quinault Dep. Nat. Resour., Taholah, WA 98587] Excessive cleanup of logging residues along small streams can deplete the stream environment of large, stabilized organic debris. An experiment was conducted to determine

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86-005396 CONTINUED the effects on a resident salmonid population of overcleaning a stream course of organic debris. The study was conducted in two headwater streams of the Clearwater River in Washington during 1972 and 1973. Clearing of the stream had little or no effect on numbers and biomass of cutthroat (*Salmo clarki clarki*) immediately after alteration and prior to winter. Subsequently, population reductions occurred in the treated stream over winter 1972-1973, but these losses were short-term. The decline in numbers of overwintering trout was apparently associated with habitat instability brought on by the removal of large organic debris from the stream channel. Within 1 year of debris removal, the cutthroat trout population has returned to pretreatment levels. Also the physical habitat characteristics of the altered stream were largely restored to pretreatment conditions within 1 year of debris removal. If there had not been a source of debris to replace that which was removed, habitat and fish recovery may have been slower.

86-005397 Linfield, R. S. J. THE EFFECT OF HABITAT MODIFICATION ON FRESHWATER FISHERIES IN LOWLAND AREAS OF EASTERN ENGLAND. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 147-156. In English with French summ. FR 31(4)

86-005398 McCarthy, D. T. THE ADVERSE EFFECTS OF CHANNELIZATION AND THEIR AMELIORATION. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 83-97. In English with French summ. FR 31(4)

86-005399 McGrath, C. J. THE ROLE OF THE FISHERIES ENGINEER IN THE DESIGN AND EXECUTION OF ARTERIAL DRAINAGE SCHEMES. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 98-103. In English with French summ. FR 31(4)

86-005400 Modde, T.; H. G. Drewes and M. A. Rumble. EFFECTS OF WATERSHED ALTERATION ON THE BROOK TROUT POPULATION OF A SMALL BLACK HILLS STREAM. *Great Basin Nat.* 46(1):39-45. 1986. FR 31(4)
[Dep. Wildl. Fish. Sci. Box 2206, Brookings, SD 57007]

86-005401 Murphy, M. L.; J. Heifetz; S. W. Johnson; K. V. Koski and J. F. Thedinga. EFFECTS OF CLEAR-CUT LOGGING WITH AND WITHOUT BUFFER STRIPS ON JUVENILE SALMONIDS IN ALASKAN STREAMS. *Can. J. Fish. Aquatic. Sci* 43(8): 1521-1533. 1986. In English with French summ. FR 31(4)
[NMFS, P.O. Box 210155, Auke Bay, AK 99821]

86-005402 Myren, T. T. and R. J. Ellis. EVAPOTRANSPIRATION IN FOREST SUCCESSION AND LONG-TERM EFFECTS UPON FISHERY RESOURCES: A CONSIDERATION FOR MANAGEMENT OF OLD-GROWTH FORESTS. *IN W. R. Meehan; T. A. Merrell, Jr. and T. A. Hanley (eds.). (Am. Inst. Fish. Res. Biol.).* p. 183-186. 1984. Available @ $20.00 From J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Box 1024, Lanai, HI 96763] Evapotranspiraton of rapidly growing forests may markedly reduce the minimum streamflows during the summer. In many streams of southeast Alaska, the minimum summer streamflows limit spawning success of pink and chum salmon and may limit the habitat of species such as coho salmon that rear in streams. Extrapolating from the literature leads to the conclusion that converting significant portions of old-growth watershed to rapidly growing second-growth forest risks permanently reducing summer low flows of the streams and, thus their ability to produce salmon. It is recommended that this risk be considered in managing the forests and that effects on streamflow of converting old-growth forests to second-growth forests be included in studies of logging in southeast Alaska.

HABITAT ALTERATIONS (CONTINUED)

86-005403 Pennington, C. H., S. S. Knight and M. P. Farrell. RESPONSE OF FISHES TO REVETMENT PLACEMENT. *Proc. Ark. Acad. Sci.* 39:95-97. 1985. FR 31(4)
[ACE, Waterways Exp. Stn., P.O. Box 631, Vicksburg, MS 39180]

86-005404 Pollard, J. E.; S. M. Melancon and L. S. Blakey. IMPORTANCE OF BOTTOMLAND HARDWOODS TO CRAWFISH AND FISH IN THE HENDERSON LAKE AREA, ATCHAFALAYA BASIN, LOUISIANA. *Wetlands* 3:1-25. 1983. FR 31(4)
[Dep. Biol. Sci., Univ. Nev., 4505 Maryland Parkway, Las Vegas 89154]

86-005405 Poulin, V. A. AN APPROACH TO SOLVING CONFLICTS RELATED TO FISH AND OLD-GROWTH LOGGING ON THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA. N W. R. Meehan; T. R. Merrell, Jr. and T. A. Hanley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. Res. Biol.) p. 167-174. 1984. Available @ $20.00 from J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Fish/Forestry Interaction Prog., 2153 W. 46th Ave., Vancouver, BC V6M 2L2, Canada]

86-005406 Reynolds, J. B. LAND DEVELOPMENT IN THE CHENA RIVER WATERSHED. *Alaska Sci. Conf.* 36:139. 1985. Abstract only. FR 31(4)
[Alaska Coop. Fish. Res. Unit, Univ. Alaska, Fairbanks 99775-0110]

86-005407 Rivier, B. and J. Seguier. PHYSICAL AND BIOLOGICAL EFFECTS OF GRAVEL EXTRACTION IN RIVER BEDS. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 131-146. In Enlgish with French summ. FR 31(4)

86-005408 Rogers, A. and A. Cane. EFFECTS ON SALMONID POPULATIONS OF ISOLATION OF A LAKE FROM A RIVER SYSTEM. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 159-164. In English with French summ. FR 31(4)

86-005409 Sakaki, N. and T. Okamoto. FREE FALLING INSTALLATION TEST OF ARTIFICIAL STEEL REEF. *In: W. Kato, (ed.). Ocean Space Utilization '85: Proc. Int. Symp. Nihon Univ.* Vol. 2. 1985. p. 497-503. FR 31(4)
[Civil Eng. Lab., Struc. Res. Dep., Tech. Res. Cent., Nippon Kokan K.K., Minami-Watarida, Kawasaki, 210 Japan]

86-005410 Samuelson, C. E. LOGGING AND FISH HABITAT--PRELIMINARY REVIEW OF THE RESULTS OF A LONG-TERM STUDY OF FIVE STREAMS IN THE OLYMPIC PENINSULA, WASHINGTON. *IN W. R. Meehan; T. R. Merrell, Jr. and T. A. Hanley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. Res. Biol.).* p. 151. 1984. Available @ $20.00 from J. W. Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. Abstract only. FR 31(4)
[ITT Rayonier Inc., Shelton, WA] Effects of logging on fisheries habitat in five small watersheds on the Olympic Peninsula were studied from 1972 to 1979. Studies were designated to represent current logging practices in an old-growth forest. Areas were harvested under the requirements of "best management practices" within the quidelines of Washington State Forest Practices Act. Sampling was conducted during summer low streamflow periods from June to September. Each area was studied for a minimum of three summers before and three summers after logging. Uncut areas located upstream were sampled throughout the study. The study was designed primarily as a fish-habitat investigation. Physical parameters studied included composition of spawning gravel and characteristics of stream temperature. Stream dimensions and flows were monitored to support other parameters. Chemical measurements

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86-005410 CONTINUED included dissolved oxygen (DO), subgravel dissolved oxygen, conductivity, color, pH, and turbidity. Biological monitoring included riffle benthos and fish populations. Although analyses of data are continuing, the following findings are indicated: 1. Effects on fish populations are not apparent. Where fish biomass or composition changes occur, parallel changes are seen in upstream controls. 2. There is an overall trend for increased biomass of riffle benthos. 3. Composition of riffle benthos is generally unchanged, but further analyses are required. 4. Effects on fines (<0.83mm) in spawning gravel varied. Small increases measured in one stream are not considered to be of a magnitude that should affect fish production. 5. Mean, absolute maximum, and diurnal fluctuations of water temperature increased after logging and will probably persist for several years. 6. Data suggest that other water parameters (including subgravel DO) have not greatly changed. 7. Logging that is properly conducted and supervised within the constraints of present environmental guidelines is compatible with fisheries production in small headwater streams in western Washington.

86-005411 Scott, J. B.; C. R. Steward and Q. J. Stober. EFFECTS OF URBAN DEVELOPMENT ON FISH POPULATION DYNAMICS IN KELSEY CREEK, WASHINGTON. *Trans. Am. Fish. Soc.* 115(4):555-567. 1986. FR 31(4)
[Northwest Indian Fish. Comm., 6730 Marten Way East, Olympia WA 98506]

86-005412 Sheridan, W. L.; M. P. Perensovich and T. Faris. SEDIMENT CONTENT OF STREAMBED GRAVELS IN SOME PINK SALMON SPAWNING STREAMS IN ALASKA. *IN W. R. Meehan; T. R. Merrell, Jr. and T. A. Hanley (eds.). Fish and Wildlife Relationships in Old-Growth Forests. (Am. Inst. Fish. Res. Biol.)*. p. 153-165. 1984. Available @ $20.00 from J. W Reintjes, Rt. 4, Box 85, Morehead City, NC 28557. FR 31(4)
[Box 368, Juneau, AK 99802] Composition of gravel was measured in selected pink salmon spawning riffles in several streams in southeast Alaska, one stream in Prince William Sound, during the period 1963-1971. Over 2,000 streambed samples were analyzed for fine particulate matter. The point measurement, percent <0.83 mm in diameter, was used throughout. There was good agreement between percent <0.83 and the "fredle index," and between results of analyzing gravel samples by the volumetric (wet) method and gravimetric (dry) method. The mean percent particle size <0.83 mm for 18 streams was 8.9. Seperation of streams in logged watersheds from those in unlogged watersheds resulted in means of 9.1 percent for streams in logged drainages and 7.1 percent for streams in unlogged watersheds, but tests with a nested Ananysis of Variance showed no significant difference in percent fines <0.83 between six streams in logged watersheds and six streams in unlogged watersheds; Test for differences between sediment levels sampled during different seasons showed significant differences in some cases, and none in others.

86-005413 Sparrowe, R. D. THREATS TO PADDLEFISH HABITAT. *North Cent. Div. Am. Fish. Soc. Spec. Publ.* No. 7. p.36-45. 1986. Available at $9.00 ($11.00 Foreign) from Joe G. Dillard, 1110 College Ave., Columbia, Mo 65201. FR 31(4)
[U.S.FWS, Washington, DC 20240]

86-005414 Spillett, P. B.; G. S. Armstrong and P. A. G. Mcgrath. AMELIORATIVE METHODS TO REINSTATE FISHERIES FOLLOWING LAND DRAINAGE OPERATIONS. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 124-130. In English with French summ. FR 31(4)

86-005415 Teubert, B. D. CHANGES IN THE TROUT FISHERIES OF THE LOWER COLORADO RIVER AND ARIZONA. *In: Richardson, F. and R. H. Hamre (Tech. eds.). Wild Trout III.* p. 175-180. 1985. FR 31(4)
[Ariz. Game Fish Dep., 2222 W. Greenway Rd., Phoenix, AZ]

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86-005416 Tuunainen, P.; K. Westman; O. Heikinheimo-Schmid; M. Pursiainen and K. Salojarvi. [THE 13TH SESSION OF THE EUROPEAN INLAND FISHERIES ADVISORY COMMISSION (EIFAC) AND THE SYMPOSIUM ON HABITAT MODIFICATION AND FRESHWATER FISHERIES.] *Tiedonantoja* No. 23. 33-51. 1985. In Swedish. FR 31(4)

86-005417 Unkenholz, D. G. EFFECTS OF DAMS AND OTHER HABITAT ALTERATIONS ON PADDLEFISH SPORT FISHERIES. *North Cent. Div. Am. Fish. Soc. Spec. Publl.* No. 7. p.54-61. 1986. Available at $9.00 ($11.00 Foreign) from Joe G. Dillard, 1110 College Ave., Columbia, MO 65201. FR 31(4)
[S.D. Dep. Game Fish Parks, Pierre 57501]

86-005418 Volovik, S. P. CHANGES IN THE ECOSYSTEM OF THE AZOV SEA IN RELATION TO ECONOMIC DEVELOPMENT IN THE BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 26(2):1-15. 1986. FR 31(4)
[AzNIIRKH, Rostov-on-Don, USSR]

86-005419 Ward, G. M. and N. G. Aumen. WOODY DEBRIS AS A SOURCE OF FINE PARTICULATE ORGANIC MATTER IN CONIFEROUS FOREST STREAM ECOSYSTEMS. *Can. J. Fish. Aquatic Sci.* 43(8):1635-1642. 1986. In English with French summ. FR 31(4)
[Aquatic Biol. Prog., Dep. Biol., Univ. Ala., University 35486]

86-005420 Westman, K. EFFECTS OF HABITAT MODIFICATION ON FRESHWATER CRAYFISH. *IN: J. S. Alabaster, (ed.). Habitat Modification and Freshwater Fisheries. FAO of the UN.* 1985. p. 245-255. In English with French summ. FR 31(4)

86-005421 Wilzbach, M. A. and K. W. Cummins. INFLUENCE OF HABITAT MANIPULATIONS ON INTERACTIONS BETWEEN CUTTHROAT TROUT AND INBERTEBRATE DRIFT. *Ecology* 67(4):898-911. 1986. FR 31(4)
[Cent. Environ. Estuarine Stud., Appl. Environ. Lab., Univ. Md., Frostburg 21532]

HARVEST, CREEL CENSUS, ETC.

86-005422 Aggus, L. R.; G. R. Ploskey and R. M. Jenkins. SURVEY OF STATE SAMPLING METHODS TO IDENTIFY NEW REGIONAL OR NATIONAL DATA BASES ON RESERVOIR FISHERY RESOURCES. *Great Lakes Fish. Lab. Admin. Rep.* No.86-4. 37p. 1986. FR 31(4)
[U.S.FWS, Great Lakes Fish. Lab., 1451 Green Rd., Ann Arbor, MI 48105]

86-005423 Anderson, R. S.; C. J. Schwinden and J. A. Leitch. REGIONAL ECONOMIC IMPACT OF THE DEVILS LAKE FISHERY. *Fisheries (Bull. Am. Fish. Soc.)* 11(5):14-17. 1986. FR 31(4)
[Wash. Sea Grant Prog., Wash. State Univ., 1919 N.E. 78th St., Vancouver 98665]

86-005424 Battaglene, S. C. A CREEL SURVEY OF THE LAKE KEEPIT RECREATIONAL FISHERY. *Aust. Zool.* 21(6-7):565-578. 1985. FR 31(4)
[N.S.W. Dep. Agric., Div. Fish., P.O. Box 21, Cronulla, NSW 2230, Australia]

HARVEST, CREEL CENSUS, ETC. (CONTINUED)

86-005425 Brusher, H. A. and B. J. Palko. CHARTERBOAT CATCH AND EFFORT FROM SOUTHEASTERN U.S. WATERS, 1983. *Mar. Fish. Rev.* 47(3):54-66. 1985. FR 31(4)
[NMFS, 3500 Delwood Beach Rd., Panama City, FL 32407-7499]

86-005426 FAO of the UN. YEARBOOK OF FISHERY STATISTICS. *FAO Fish. Ser.* 26. vii+309p. 1986. In English, French and Spanish. FR 31(4)
[Rome, Italy]

86-005427 Graefe, A. R. and R. B. Ditton. BAY AND OFFSHORE FISHING IN THE GALVESTON BAY AREA: A COMPARATIVE STUDY OF FISHING PATTERNS, FISHERMEN CHARACTERISTICS, AND EXPENDITURES. *N. Am. J. Fish. Manage.* 6(2):192-199. 1986. FR 31(4)
[Dep. Recreation Parks, Pa. State Univ., University Park 16803]

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[N.Y. State Dep. Environ. Conserv., Albany] Catch and release regulations are an effective tool for accomplishing a variety of wild salmonid management objectives in New York. Absolute or partial harvest restrictions have been successfully employed to: 1) increase angler catch rates of wild brown, rainbow and lake trout; 2) reduce need for stocking to maintain acceptable stream brown trout and lake trout fisheries; 3) restore or enhance wild brown trout, rainbow and lake trout populations; and 4) in limited instances, increase the maximum size, abundance and catch rate of large stream trout. Attainment of these objectives has typically been at a cost in take-home yeild, but size limit protection has frequently produced increased yields. Implementation of catch and release regulations has typically caused short-term depression in angler use followed by partial or complete recovery within several years. Neither lack of angler compliance nor hooking mortality have precluded attainment of catch and release objectives. Short and long-term impacts of harvest restrictions have frequently been different and distinct. Evaluation schemes for catch and release management programs should include several years of post-implementation monitoring.

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[Inst. Fish. Res., Mich. Dep. Nat. Resour., Ann Arbor 48109] Fishing regulations for brown trout were changed from a 12-inch minimum to a slotted size limit. The slotted limit allowed harvest of trout between 8 and 12 inches and over 16 inches. Abundance of brown trout smaller than 8 inches decreased by 8%, abundance of 8- to 12-inch brown trout decreased by 32%, and abundance of brown trout over 12 inches decreased by 47%. Growth rate did not change significantly. Annual fishing mortality rate between ages 2 and 3 increased from near zero to about 30%, and this reduced the number of fish surviving to older ages and larger sizes. However, unfavorable changes in environmental conditions contributed to decreases in abundance also. Total numerical harvest of brown trout increased nearly five times but consisted of smaller fish. Fishing pressure probably increased somewhat, but the increase in harvest was due primarily to the change in size limits. Voluntary release of legal-sized trout appeared to increase independent of our regulations. We concluded that the greatest effect of the slotted limit was in reshaping man's use of the trout populations. Biological effects were comparatively unimportant, except for their influence on satisfying desires of different factions within the angling community.

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[USDA For. Serv., Juneau, AK] Because land management may affect a stream system at various points along its progression to the sea, it is important to identify zones used in the watershed by juvenile salmonids. This 2-year study examined the distribution of juvenile salmonids in an undisturbed,

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86-005585 CONTINUED old-growth forest drainage. The purpose of the study was to determine the distribution of juvenile salmonids in a small stream basin from the main stream through the upper tributaries. Differences in density, species ratios, and size among juvenile salmonids in main-stream zones, lower tributary zones, and upper tributary zones were observed. Upper reaches of tributaries were used by age-0 coho, cutthroat trout, and Dolly Varden. Lower reaches of tributaries were extensively used by juvenile coho of all age-classes and Dolly Varden up to about 120mm in length. Main-stream zones were sparsely populated by all species, but where off-channel rearing areas were available, coho were more abundant. Differences in density occurred from early summer to early fall.

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[USDA For. Serv., Corvallis, OR] Forest vegetation strongly affects habitat in streams and rivers of all sizes. Streams associated with old-growth forests are dominated by large tree-sized woody debris. Large woody debris traps sediment and creates a great diversity of habitat for both fish and aquatic invertebrates. Woody debris slows the routing of finer organic matter, and allows organisms time to more fully process these materials before they are moved downstream. The structural influences of woody debris differ little between streams flowing through old-growth and through natural, young, post-wildfire stands. Large logs may reside in a channel for a century, or more, and provide a variety of benefits to the aquatic ecosystem until the post-wildfire stand matures to the point of contrubuting large debris to the channel. The United States has few remaining examples of the full, natural interaction of rivers with adjacent forests except in Alaska and national parks. Undisturbed streams in old-growth forests are restricted to small, high-gradient examples in relatively inaccessible and mountainous areas. A rich archival record documents man-imposed changes in forest influences on rivers in a variety of regions and geological and topographic settings. These old records--from fur trappers, the U.S. Army Corps of Engineers, and others--describe natural river systems greatly influenced by numerous downed trees, and large jams of floated debris.

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Indiana: Interior Low Plateau
86-000754
Indiana: LaPorte Cty.: Kingsbury State Fish Wildl. Area
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Indonesia
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Iowa
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Iowa: Clear Lake
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Iowa: Dickinson Cty.: West Okoboji Lake
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Iran
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Iraq: Tartar Reservoir
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Ireland
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Irian Jaya
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Irish Sea
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86-001661

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Israel: Lake Kinneret
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Israel: River Jordan
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Italy
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Italy: Lago di Annone
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Italy: Po River Delta
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Ivory Coast
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Japan
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Japan: Chicugo Estuary
86-001656
Japan: Chitose River
86-004418
Japan: Hokkaido: Assabu River
86-003729
Japan: Hokkaido: Ohno River
86-003747
Japan: Miyake-jima
86-001702
Japan: Mu River
86-002726
Japan: Sagami Bay
86-001654
86-004275
Japan: Saru River
86-002726
Japan: Sendai Bay
86-004523
Japan: Seto Sea
86-002829
86-002830
Japan: Shin Tone River
86-000592
Japan: Suo-nada
86-001700
Japan: Suruga Bay
86-002700
86-002738
86-004544
Japan: Tama River
86-001636
Japan: Tokachi River
86-003397
86-003398
Japan: Tosa Bay
86-000763
Japan: Wakasa Bay
86-000685
86-004461
Japan: Yurappu River
86-004266
Johnston Atoll
86-002735
Jordan: Aqaba
86-000708
Kansas
86-000798
86-003312
86-004095
Kansas: Lone Star Lake
86-004572
Kentucky
86-000582
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86-002633
Kentucky: Buck Creek
86-000755
Kentucky: Clarks River
86-001728
Kentucky: Herrington Lake
86-002836
86-003234
Kentucky: Interior Low Plateau
86-000754
Kentucky: Ohio River
86-003210
Kentucky: Rolling Fork
86-001722
Kenya: Lake Nakuru
86-004032
Korea
86-004118
Kuwait
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86-002730

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- Lake Erie
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  - 86-002797
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  - 86-004361
  - 86-004371
  - 86-004752
- Lake Erie: Long Point Bay
  - 86-001748
- Lake Huron
  - 86-000576
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  - 86-005126
- Lake Michigan
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- Lake Michigan: Green Bay
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  - 86-001223
- Lake Ontario
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- Lake Superior
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- Lake Tanganyika
  - 86-004278
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  - 86-004560
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- Laos: Nam Ngum Reservoir
  - 86-004486
- Lebanon
  - 86-003039
  - 86-004532
- Liberia
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- Louisiana
  - 86-000946
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  - 86-002088
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  - 86-002599
  - 86-002769
  - 86-004243
- Louisiana: Bayou Sara
  - 86-002683
- Louisiana: Grand Isle
  - 86-002855
- Louisiana: Henderson Lake
  - 86-005404
- Madagascar
  - 86-004281
- Maine
  - 86-000951
  - 86-001105
  - 86-001750
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- Maine: Gulf of Maine
  - 86-000727
  - 86-001945
- Maine: Hancock Cty.: Green Lake
  - 86-001225
- Maine: Kennebec River
  - 86-003197
- Maine: Penobscot River
  - 86-001657
- Malawi: Lake Chilwa
  - 86-004699
- Malawi: Lake Malawi
  - 86-000667
  - 86-001171
  - 86-001678
  - 86-002912
  - 86-004417
  - 86-004874
- Malaysia
  - 86-000021
  - 86-001840
  - 86-002810
  - 86-002907
  - 86-003383
  - 86-004297
- Malaysia: Kwala Lumpur: Zoo Negara Lake
  - 86-004386
- Malaysia: Pulau Penang
  - 86-001796
- Mariana Islands
  - 86-005670

Marshall Islands
86-004217
86-004377
86-004457
86-004727
Marshall Islands: Enewetak Atoll
86-001632
Maryland
86-001856
86-001857
Maryland: Chesapeake Bay
86-001251
Maryland: Nanticoke River
86-000950
Massachusetts
86-003302
86-005581
Massachusetts: Great Sippewisett Marsh
86-004613
Massachusetts: Taylor Brook
86-005215
Mediterranean Sea
86-000529
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Mediterranian Sea
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Mexico
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Mexico: Baja California
86-004301
Mexico: Baja California: Colorado River
86-004666
Mexico: Baja California: Laguna Salada
86-004675
Mexico: Chihuahua
86-004107
86-005359
Mexico: Cuatro Cienegas
86-000545
Mexico: Gulf of Mexico
86-002742
Mexico: Jalapa
86-004159
Mexico: Laguna Chichancanab
86-004114
Mexico: Lake Chapala
86-003684
Mexico: Mesa Central
86-004815
Mexico: Nuevo Leon: Cadereyta Jimenez
86-005217
Mexico: Sonora
86-004354
Mexico: Sonora: Rancho la Brisca
86-001785
Mexico: Southern California
86-003347
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Michigan
86-000598
86-001144
Michigan; Hunt Cr.
86-003290
Michigan: Au Sable River
86-004326
86-005444
Michigan: Chippewa Cty.: St. Mary's River
86-002853
Michigan: Crawford Cty.: Au Sable River
86-001797
Michigan: Detroit River
86-000968
Michigan: Lake St. Clair
86-000968
Michigan: Manitoulin Lakes
86-004692
Michigan: Menominee River
86-001247
Michigan: Montmorency Cty.: Fuller Pond
86-005471
Middle East
86-002022
86-002023
Minnesota
86-002643
86-003211
Minnesota: Lake Itasca
86-004614
Minnesota: South Branch Creek
86-004362
Mississippi
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Mississippi River
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Mississippi River, Upper
86-000542
Mississippi: Buffalo River
86-001717
Mississippi: Homochitto River
86-001717
Mississippi: Little Tallahatchie River
86-001598
Missouri
86-000833
86-005363
Missouri: Missouri River
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Montana
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86-004765
86-005209
86-005454
86-005584
Montana: Big Hole River
86-004682
Montana: Flathead River
86-002206

Montana: Kootenai River
86-002206
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Montana: Madison River
86-005488
Montana: Missoula Cty.: Gold Creek
86-001130
Morocco
86-002030
Nebraska
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Netherlands
86-003085
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Netherlands: Tjeukemeer
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Nevada
86-004294
Nevada: Ash Meadows
86-000811
Nevada: Gance Creek
86-000832
Nevada: Lahontan Lake
86-000669
Nevada: Lake Mohave
86-004423
Nevada: Walker Lake
86-004242
Nevada: White River
86-000792
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New England
86-005623
New Guinea
86-004845
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New Hampshire
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New Jersey
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New Jersey: Raritan Bay
86-003337
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86-003354
New Jersey: Round Valley Reservoir
86-002198
New Mexico
86-004126
New Mexico: Pecos River
86-000535
New Mexico: San Juan River
86-002642
New York
86-001145
86-001963
86-001964
86-005442
New York: Adirondack Mtns.
86-005163
86-005210
New York: Albany: Tivoli Lakes Urban Wildlife Park
86-005187
New York: Black Lake
86-002737
New York: Hudson River
86-002820
86-005093
New York: Hudson River Estuary
86-000526
New York: Lake Champlain
86-000736
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New York: Lake Champlain
86-002758
New York: Long Island
86-003057
New York: Long Island Sound
86-004566
New York: New York Bight
86-000960
New York: Niagara River
86-001148
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New Zealand
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New Zealand: Ashley River
86-004589
New Zealand: Campbell Plateau
86-000660
86-000661
New Zealand: Canterbury: Lake Ellesmere
86-001685
New Zealand: Hawke Bay
86-001275
New Zealand: Kaikoura
86-002849
New Zealand: Pauatahanui Inlet
86-001725
New Zealand: Porirua Inlet
86-001725
New Zealand: Rakaia River
86-004293
86-004772
New Zealand: Rangitikei River
86-000637
New Zealand: Smith Island
86-003032
New Zealand: Waitaki River
86-001655
Nigeria
86-003430
Nigeria: Kano State: Tiga Lake
86-004289
Nigeria: Lake Kainji
86-003280
Nigeria: Sokoto-Rima River
86-002781
Nile River
86-004387
North America
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North Carolina
86-001096

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- North Carolina
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- North Carolina: Chowan River
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- North Carolina: Lake Norman
  - 86-000643
- North Dakota
  - 86-002930
- North Dakota: Devils Lake
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- North Sea
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- Northern Ireland
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- Norway
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- Norway: Lake Gjersjoen
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- Norway: Lake Selura
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- Norway: River Nidelva
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- Norway: Vangsvatnet Lake
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- Ohio River
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- Ohio: Pike Cty.: Scioto River
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- Ohio: Richland Cty.: Clear Fork
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- Ohio: Richland Cty.: Rocky Fork
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- Ohio: Sandusky River
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- Oklahoma
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- Oklahoma: Beaver Cty.
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- Oklahoma: Delaware Cty.: Flint Creek
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- Oklahoma: Harper Cty.
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- Oklahoma: Lake Carl Blackwell
  - 86-002199
- Oklahoma: Lake Texoma
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- Oman
  - 86-003204
- Oregon
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- Oregon: Columbia River
  - 86-004534
  - 86-005540
- Oregon: Lane Cty.: Grasshopper Creek
  - 86-004616
- Oregon: Rogue River
  - 86-000924
- Oregon: Sixes River
  - 86-004646
- Oregon: Snake River
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- Oregon: Tobe Ck.
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- Oregon: Winchester Bay
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- Pacific Ocean
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Pacific Ocean, Southeastern
86-002864
Pacific Ocean: Aleutian Basin
86-004300
Pacific Ocean: Bay of Korf
86-000681
Pacific Ocean: California Current
86-002213
Pacific Ocean: Great Barrier Reef
86-001622
86-001626
Pacific Ocean: Hawaii
86-000463
Pacific Ocean: Sitka Eddy
86-004754
Pacific Ocean: South China Sea
86-000541

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- Pacific Ocean: South China Sea
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- Pacific Ocean: Strait of Georgia
  - 86-002006
- Pakistan: Kabri Lake
  - 86-005081
- Pakistan: Sind: Kalri Lake
  - 86-005114
- Papua New Guinea
  - 86-000603
  - 86-001713
  - 86-002704
  - 86-005125
- Papua New Guinea: Sepik River
  - 86-001994
- Paraguay
  - 86-000840
  - 86-001787
- Pennsylvania
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  - 86-003296
  - 86-005345
- Pennsylvania: Cumberland Cty.: Letort Spring Run
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- Peru
  - 86-001695
  - 86-002854
  - 86-004902
- Peru: Andes
  - 86-004525
- Peru: Lake Sauce
  - 86-004659
- Philippines
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  - 86-003386
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  - 86-004355
  - 86-004921
- Philippines: Lake Lanao
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- Poland
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  - 86-004654
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  - 86-004915
  - 86-005478
- Poland: Lake Warniak
  - 86-002710
- Poland: Oder River
  - 86-004094
- Poland: River Dunajec
  - 86-002840
  - 86-002869
  - 86-004617
- Poland: River Nysa Klodzka
  - 86-002874
- Poland: River Peczora
  - 86-002901
- Poland: Vistula River
  - 86-005376
- Portugal
  - 86-000751
  - 86-004956
- Portugal: Lagoon of Aveiro
  - 86-003075
- Potomac River
  - 86-004702
- Puerto Rico
  - 86-000823

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- Puerto Rico
  - 86-000913
  - 86-001584
  - 86-005097
- Puerto Rico: Laguna Joyuda
  - 86-004737
- Puget Sound
  - 86-002010
- Red Sea
  - 86-003315
  - 86-004681
  - 86-004800
- Rhode Island
  - 86-002770
- Rhode Island: Hamilton Reservoir
  - 86-004610
- Rhode Island: Narragansett Bay
  - 86-000764
- Rhode Island: Pawcatuck River
  - 86-005093
- River Jordan
  - 86-001995
- Romania: Danube River
  - 86-005375
- Sargasso Sea
  - 86-001743
- Saudi Arabia
  - 86-002021
  - 86-003315
- Scotland
  - 86-002882
  - 86-003044
  - 86-004258
- Seychelles Islands
  - 86-004704
- Sierra Leone: Taia River
  - 86-002731
- Singapore
  - 86-001293
  - 86-002112
- South Africa
  - 86-000518
  - 86-000606
  - 86-000695
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  - 86-004951
  - 86-005041
- South Africa: Boskop Dam
  - 86-003048
- South Africa: Hartbeespoort Dam
  - 86-004169
  - 86-004502
- South Africa: Kei River Estuary
  - 86-001733
- South Africa: Lake le Roux
  - 86-004755
- South Africa: Lake Sibayi
  - 86-004820
- South Africa: Mgobozeleni Lake
  - 86-004670
- South Africa: Natal
  - 86-001232
  - 86-002717
  - 86-002751

South Africa: Swartvlei
86-005580
South Africa: Transvaal
86-000765
86-001823
South Africa: Tyume River
86-004251
South Africa: Zambezi River
86-004894
South America
86-000782
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South Carolina
86-000162
86-001267
86-003334
86-004672
South Carolina: Charleston Harbor
86-000732
South Carolina: Chesterfield Cty.: Carolina Sandhills Natl. Wildl. Refuge
86-004717
South Carolina: Cooper River
86-001237
86-002925
South Carolina: Jocassee Reservoir
86-001169
South Carolina: Santee River
86-001237
South Carolina: Wee Tee Lake
86-000770
South China Sea
86-004712
86-005636
South Dakota
86-000001
South Dakota: Cheyene River
86-005212
South Dakota: Pennington Cty.: Slate Creek
86-005400
South Dakota: Rapid City: Rapid Creek
86-005388
Spain
86-000881
86-003749
86-004349
86-005024
Spain: Duero Basin
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  - England: River Trent
    - 86-002848
  - England: Severn River Estuary
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    - 86-000784
  - India: Kota District
    - 86-000779
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  - Mexico: Baja California: Colorado River
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    - 86-004695
  - Pacific Ocean: Oregon
    - 86-001715
  - Pacific Ocean: Peru
    - 86-002854
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    - 86-002869
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    - 86-002874
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  - Ligictaluridus posthon
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  - Ligula intestinalis
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    - 86-003049
  - Lincomycin
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  - Lintaxine cokeri
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  - Liver Lesions
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  - Loma morhua
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  - Lophoura gracilis
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  - Lordosis
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  - Lymphocystis
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  - Lymphosarcomas
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  - Magathylacus brooksi
    - 86-003012
  - Mariporrocaecum
    - 86-005140
  - Methemoglobinemia
    - 86-000895
  - Microgemma hepaticus
    - 86-005043
  - Microsporidia
    - 86-005040
  - Mites
    - 86-005099
  - Mocardia kampachi
    - 86-002950
  - Multicalyx cristata
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  - Multinucleate Giant Cells
    - 86-000929
  - Mycobacterium chelonei
    - 86-004947
  - Mycoplasmas
    - 86-002959
  - Myctophilus sprostonae
    - 86-005133
  - Myxobolus
    - 86-003009
  - Myxobolus encephalicus
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  - Myxobolus insidiosus
    - 86-005025
  - Myxobolus kotlani
    - 86-002983

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- Parasites/Diseases
  - Myxosoma cerebralis
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  - Myxosporea
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  - Myxosporidia
    - 86-000885
    - 86-002985
  - Nematodes
    - 86-000906
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    - 86-001822
    - 86-001837
    - 86-001844
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    - 86-003007
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    - 86-003041
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    - 86-005118
    - 86-005122
    - 86-005123
    - 86-005140
    - 86-005144
  - Neoechinorhynchus cylindratus
    - 86-002999
  - Neoechinorhynchus prolixoides
    - 86-005076
  - Neoechinorhynchus robertbaueri
    - 86-005076
  - Nephroblastoma
    - 86-005100
  - Nerocila acuminata
    - 86-003034
    - 86-003051
  - Nodular Excrescences
    - 86-005145
  - Nodular Gill Disease
    - 86-000870
    - 86-005094
  - Nutritional Diseases
    - 86-000922
    - 86-000926
    - 86-003025
    - 86-003036
  - Octosporella
    - 86-000889
  - Ommatokoita
    - 86-005106
  - Onchocleidus interruptus
    - 86-005079
  - Onchocleidus mimus
    - 86-005079
  - Opistholebetidae
    - 86-001826
  - Orientocrendium batrachoides
    - 86-005143
  - Ormethoprim
    - 86-005017
  - Osteochilotrema malayae
    - 86-001840
  - Otobothrium kurisi
    - 86-000930
  - Pachycreadium carnosum
    - 86-003039
  - Pallisentis kalriai
    - 86-005114
  - Pancreas Disease
    - 86-001835

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Parasites/Diseases
Paradeontacylix
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Paraechinorhynchus kalriai
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Parasitic Ciliates
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Parasitic Copepods
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86-005138
Parasitic Isopods
86-003034
86-003051
Parasitic Mites
86-001834
Parasitic Molluscs
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86-005077
Parasitic Turbellarians
86-005113
Parasiticides
86-002934
Paravortex
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Pasteurella
86-004963
86-005013
Pasteurella piscicida
86-005012
Pennella
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Phagicola longa
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86-005150
Philometra channai
86-005118
Phoma
86-002969
Piscicola salmositica
86-001825
Pleistophora priacanthicola
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Pleorchiidae
86-001826
Plesiomonas shigelloides
86-004956
Pomphorhynchus laevis
86-005084
Pomphorhynchus rocci
86-001842
Porrocaecum
86-005140
Proliferative Kidney Disease
86-002979

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Parasites/Diseases
Proliferative Kidney Disease
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Protocephalus
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Protozoan Diseases
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Pseudascarophis kyphosi
86-000921

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Parasites/Diseases
Pseudomonas
86-002964
Pseudomonas anguilliseptica
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Pseudomonas fluorescens
86-004959
Pseudotuberculosis
86-004963
Rajonchocotyle emarginata
86-003050
Raphidascaroides trachinocephalusi
86-005117
Red Sore Disease
86-005128
Renibacterium
86-002949
Renibacterium salmoninarum
86-000863
86-002940
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86-004953
86-004954
86-004966
Reovirus 13P2
86-002988
Retrobulla angelae
86-001830
Rhabdovirus
86-005047
Rosette Agent
86-005098
Saccocoelioides godoyi
86-005116
Salmincola californiensis
86-003045
Sanguinicola fontinalis
86-000917
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Santeria rubalo
86-005083
Saprolegnia
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Silurodiscoides
86-005119
Sodium Pentachlorophenate
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Sphaerospora
86-002972
Sphaerospora araii
86-002974
Sphaerospora renicola
86-005039
Spring Viraemia
86-000894
Spring Viremia
86-002989
Staphylococcus aureus
86-005006
Streptococcus
86-000871
86-004971
86-004979
86-004994
Stress
86-001804
Subtriquetra subtriquetra
86-005153
Sulphamonometoxin
86-005017

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Parasites/Diseases
Sunburn
86-000894
86-000926
Swimbladder Disease
86-005039
Swimbladder Stress Syndrome
86-003001
Tanaorhamphus longirostris
86-001838
Telangiectasis
86-000916
Thersitina gasterostei
86-005096
Toxic Gill Necrosis
86-003046
Trematodes
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  - Triaenophorus nodulosus
    - 86-005105
  - Trifur
    - 86-003037
  - Trilocularia acanthiaevulgaris
    - 86-005121
  - Trypanoplasma borelli
    - 86-002986
  - Trypanosoma murmanensis
    - 86-000887
  - Tuberculosis
    - 86-005124
  - Tumors
    - 86-000908
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    - 86-005073
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    - 86-005265
    - 86-005268
    - 86-005314
  - Ulcer Disease
    - 86-000874
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    - 86-004976
  - Ulcers
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  - Ultrasound Imaging
    - 86-000883
  - Ultraviolet Light
    - 86-005074
  - Unio
    - 86-005077
  - Vibrio
    - 86-000873
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    - 86-004967
  - Vibrio anguillarum
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    - 86-000873
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    - 86-002939
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    - 86-002957
    - 86-002968
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    - 86-005011

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  - Viral Erythrocytic Necrosis
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  - Viral Hemorrhagic Septicemia
    - 86-002989
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  - Visceral Adhesions
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  - Whirling Disease
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  - White Spot Disease
    - 86-001813
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  - Yellowtail Ascites Virus
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    - 86-005069
  - Yersinia ruckeri
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- Physiology
  - Acidosis
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  - Acoustico-Lateralis System
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  - Air Breathing
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  - Alarm Substances
    - 86-001491
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  - Amiloride
    - 86-000317
  - Amino Acids
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  - Biochemical Composition
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- Physiology
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